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UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF BIOLOGICAL SURVEY

**FOOD HABITS OF THE AMERICAN COOT
WITH NOTES ON DISTRIBUTION**

WILDLIFE RESEARCH BULLETIN 2

UNITED STATES DEPARTMENT OF THE INTERIOR

Harold L. Ickes, Secretary

BUREAU OF BIOLOGICAL SURVEY

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Wildlife Research Bulletin 2

FOOD HABITS OF THE AMERICAN COOT
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BY

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ABSTRACT

Laboratory analyses of the contents of 801 stomachs of the American coot (*Fulica americana americana*) collected in practically all parts of its range show the bird to be primarily a vegetarian, as nearly nine-tenths of the food consisted of plants. A wide variety of both plant and animal items were eaten, but many of them, recorded only once, were of little importance. Four plant groups, pondweeds (Najadaceae), sedges (Cyperaceae), algae (Characeae and filamentous algae), and grasses (Gramineae), all popular throughout the year, were the main source of diet, having supplied more than three-fourths of the entire food and between eight- and nine-tenths of the plant content. Animal food, of importance only in summer, consisted almost entirely of insects and mollusks.

Several nonfood items were noted. Gravel, an auxiliary grinding agent, formed about a third of the gross stomach contents. Coot feathers, mere traces, doubtless ingested during preening, were present in many stomachs. Lead shot was found, but in so few stomachs (12) that it is doubtful whether poisoning from ingested lead is a serious menace to coots.

Regional division of data shows the same general types of food to be popular throughout the coot's entire range, the greatest variations occurring among the incidental foods and in certain specialized environments.

The coot's normal food habits were found to be quite inoffensive. The consumption of fish was negligible, and no evidence of cannibalism or of feeding on other birds was noted. Local depredations on California rice fields constituted the most serious damage. To prevent such injury, frightening devices to keep the birds from entering the fields or to drive them out are recommended.


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FOOD HABITS OF THE AMERICAN COOT, WITH NOTES ON DISTRIBUTION

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PURPOSE OF THE STUDY

The economic value of wild fowl, both as a source of sport and as food, is universally recognized in the United States. Unfortunately the number of these birds has decreased alarmingly, in some species almost to the point of extinction. Intelligent regulation and other methods of conservation have gone far toward overcoming the combined effects of drought, destruction of breeding grounds, and indiscriminate hunting. In order to aid the conservation work, however, it is important to know the feeding habits of the various species so that provision can be made to insure plentiful supplies of their favorite foods. The most satisfactory method of determining the desirable foods is by means of detailed stomach analyses supplemented by competent field observations.

DESCRIPTION AND HABITS OF THE AMERICAN COOT

The American coot (*Fulica americana americana*), a blackish or slate-colored bird with a white bill and a white frontal plate (pl. 1), is in habits the most ducklike American member of the family Rallidae, most of which are popularly known as rails. It is frequently seen swimming on open water or sloughs or walking about on land, occasionally far from shore in search of food, the head always bobbing in time with the foot movements. The bill somewhat resembles that of the domestic chicken, to which the bird owes the common name "mud hen" and other appellations. The feet have wide lobes, and the hind toe has a flap like that of the diving ducks. The sexes are similar, but the young are duller colored than the adults, show considerable white below, and do not have a fully developed frontal plate until late summer of the second year.

EXPLANATION OF PLATE 1 (FRONTISPIECE)

The American coot (*Fulica americana americana*).

B8046M

The coot is an excellent swimmer and diver but experiences considerable difficulty in rising from the water, using the feet as well as the wings to do so. Once in the air, it is a good flier, but it is not so speedy as the ducks. When alarmed it does not take to wing unless absolutely necessary to escape danger, preferring to swim away from it if possible. It is shy only when persistently hunted. When on land, it walks about actively, the lobed feet providing a firm footing on soft ground and not impeding motion on firmer soil. It has even been reported migrating on foot.

Although gregarious in feeding and nesting habits, the species is quite pugnacious, particularly in defence of nesting territory, when it may seriously injure or kill its fellows or other birds, especially the young.

The northward migration takes place early in spring, the coots often reaching the breeding grounds before the ice is entirely melted from the lakes. Upon arrival they spread to the smaller ponds and sloughs, where they build their nests, usually of rushes, reeds, and grass stems (pl. 2). The nests are floating structures but do not drift, as they are attached to growing reeds. They are generally partially or well concealed. The inner nest cavity, hollowed just enough to hold the eggs, is neatly lined with pieces of dried flags or other smooth material. The smooth, slightly glossy eggs are buff, heavily spotted with minute dark-brown dots, and usually number from 8 to 12. Incubation is shared by both parents and lasts 21 or 22 days. The young are decidedly precocial. They leave the nest almost immediately after hatching and can swim and dive almost as well as their parents.

Coots brave the cold, not only early in spring but also late in fall, usually deferring until the last possible moment, often until ice forms on the lakes, their southward migration to take up their winter abode on lakes and brackish sounds, lagoons, and estuaries, rarely being seen on salt water. Large rafts of the birds are common sights in winter, particularly in the southern part of the range.

DISTRIBUTION OF THE AMERICAN COOT

The range of the American coot embraces a large part of North and of Central America and extends into the West Indies, at least into the northern part, where there are valid records from Cuba and the Bahamas. Owing, however, to the presence of another race, *Fulica americana grenadensis* Riley, described from Grenada, and of another species, *F. caribaea* Ridgway, described from the Virgin Islands, it does not seem practicable to attempt to define with any great degree of accuracy the range of *F. a. americana* Gmelin in most of the West Indies until more adequate material has been collected and faunal surveys have been completed over the entire group. Indications are, however, that it does not extend much south of Cuba.



B51992

Coot on nest, about to settle down on eggs, Lower Souris Refuge, N. Dak., May 1936.



B58503; B38M

AMERICAN COOTS FEEDING.

A, Marshes between Lake Jessup and Lake Monroe, Seminole County, Fla., March 1927. *B*, Golden Gate Park, San Francisco, Calif.

BREEDING RANGE

In describing the breeding range of the American coot (fig. 1) allowance must be made for localization in nesting; thus the range

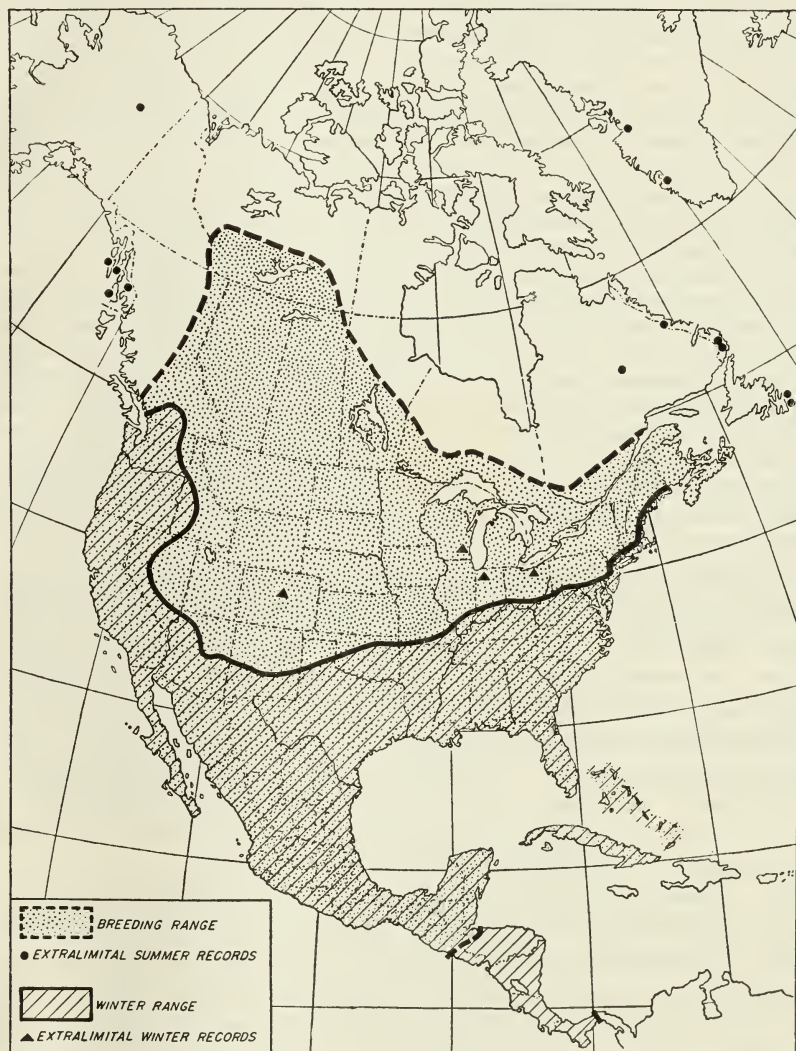


FIGURE 1.—Map showing breeding and winter ranges of the American coot.

here given does not exactly coincide with that indicated by generalized definitions, as the birds are almost absent as breeders in many areas of considerable extent within the periphery of the range. Recent records from the Biological Survey files seem to provide ample justification for

extending the range to include all the southeastern United States. The breeding range is as follows:

North to British Columbia (Quesnal, Kamloops, and Okanagan); Mackenzie (Fort Resolution, Fort Smith, Fort Simpson, and Poplar Island Creek); Saskatchewan (Prince Albert and Cumberland House); Manitoba (Moose Lake and Mouth of the Red River); Minnesota (Leech Lake and Mille Lacs Lake); Wisconsin (La Crosse, Kelley Brook, and Green Bay); Michigan (Manistee County, Saginaw, and Huron County); Ontario (Sudbury and Beaumaris); Quebec (Montreal and Quebec); New Brunswick (Chatham); and Nova Scotia (Pictou). *East* to Nova Scotia (Pictou); Massachusetts (Boston); New York (Long Island City); New Jersey (Newark and Morristown); Pennsylvania (Harrisburg and Delaware County); Maryland (Chesterton); Virginia (Knott Island); North Carolina (Pamlico Sound and Cape Fear); South Carolina (Mount Pleasant); Georgia (Savannah and Blackbeard Island); Florida (Merritt Island, Lake County, and Lake Jackson); Bahamas (Abaco and Rum Cay); Cuba (Cabañas); Texas (Fort Brown); Vera Cruz (Tampico); Quintana Roo (Cozumel Island); and Guatemala (Lake Duenas). *South* to Guatemala (Duenas); Guerrero (Laguna de Coyuca); Michoacan (Lake Patzcuaro); Jalisco (Guadalajara); Nayarit (Tepic); and Baja California (San Jose del Cabo and Todos Santos). *West* to Baja California (Todos Santos, La Purisima, San Ignacio, El Rosario, and San Telmo); California (San Diego, Los Angeles, Santa Barbara, Santa Cruz, Gridley, and Crescent City); Oregon (Bandon, Dayton, and Portland); Washington (Tacoma, Seattle, and Bellingham Bay); British Columbia (Quesnal); and Mackenzie (Fort Simpson).

The coot does not breed commonly along the Atlantic coast, the main breeding areas being from the Mississippi Valley west and northwest. Birds have been recorded in summer from various parts of eastern and southeastern United States outside of the certain breeding range as follows: Mississippi (Tishomingo County, all summer); Alabama (Oxford Lake, all summer); Georgia (Atlanta, June 4, 1931; East Lake, July 5, 1935); and West Virginia (White Sulphur Springs, all summer). Although proof of breeding in these instances has not been received, the information recorded does seem sufficient to suggest the inclusion of these areas in the breeding range.

The species has been recorded from various localities in the far north, and although the possibility that it breeds in any of them seems slight, the localities are listed as follows to show the complete territory covered by the species: Alaska (Wrangell Narrows, spring of 1932 and 1933; Sitka, September 1908; and the Stikine Flats, October 1902 and 1906); Quebec (Otter Brook, March 1914); Newfoundland (St. John's, specimen taken in November); Labrador (Sandwich Bay, August 1899; Nain, 1880; and Table Bay, October 15, 1913, specimen in collection of Biological Survey); and Greenland (Godthaab and Disco Bay, 1854).

WINTER RANGE

The winter range of the American coot (fig. 1) seems to be more uniformly populated than the breeding range, although records out-

side the usual range are probably as common as those of nonbreeding birds outside the normal breeding range. The winter range is as follows:

North to British Columbia (Sumas and Okanagan); Idaho (Deer Flat Bird Reservation); Nevada (Carson and Clark County); Arizona (Salt River Bird Reservation, Whipple, and Tucson); Texas (Pecos City, San Angelo, and San Antonio); Oklahoma (Oklahoma City); Arkansas (Poinsett and Tillar); Illinois (Anna and Mount Carmel); Kentucky (Fulton County, Hickman, and Lexington); West Virginia (Buckhannon); Maryland (Baltimore and Susquehanna Flats); New York (Montauk Point and Long Island); Rhode Island (Point Judith and Narragansett); Massachusetts (Martha's Vineyard and Boston); and Maine (Machias). *East* to Maine (Machias); Massachusetts (Boston and Martha's Vineyard); Rhode Island (Narragansett and Point Judith); New York (Montauk); Maryland (Susquehanna Flats and Baltimore); Virginia (Cobb Island and Back Bay); North Carolina (Currituck Sound and Cape Fear); South Carolina (Santee River and Charleston); Georgia (Savannah and Blackbeard Island); Florida (Palatka, Titusville, Fort Lauderdale, and Matecumbe Key); Bahamas (Abaco, New Providence, Rum Cay, and Great Inagua); Cuba (Santiago de las Vegas and San Fernando); Isle of Pines; and Panama (Almirante Bay and Calobre). *South* to Panama (Calobre and Almirante Bay); Costa Rica (Mantina River, Las Concovas, and Juan Vinas); Honduras (Lake Yojoa and Chiloma); Guatemala (Lake Duenas, Lake Armatillan, and Lake Atitlan); Guerrero (Laguna de Coyuca); Michoacan (Lake Patzcuaro and Lake Quitzeo); Colima (Manzanillo); Jalisco (Laguna de Punete, Lerma River, and Guyman); Sinaloa (Matzatlan); and Baja California (San Jose del Cabo, La Purisima, San Quentin, and San Lucas). *West* to Baja California (San Jose del Cabo, La Purisima, San Quentin, and San Lucas); California (Los Angeles, Port Pinos, and San Francisco); Oregon (Klamath Falls, Corvallis, and Netarts Bay); Washington (Seattle); and British Columbia (Sumas).

Winter occurrences outside of the normal range were noted in Alaska (Craig, November 26 to December 25, 1921), Colorado (Barr), Wisconsin (Madison), Indiana (Lake Maxinkuckee), Ohio (Lakeside), and Newfoundland (St. John's, late November).

MATERIAL AND PROCEDURE

The information on food habits presented in this bulletin was obtained from laboratory analyses of the contents of the 801 American coot stomachs contained in the collection of the Section of Food Habits of the Bureau of Biological Survey. These were collected in every month of the year and in all parts of the United States and several localities in Canada. A combined volumetric and numerical method of stomach analysis, the standard procedure of the Section of Food Habits, was followed. Record was made of the percentage furnished by every food item and by gravel (including sand), of the number of stomachs in which each item was noted, and of the number of items noted in each stomach. The food percentages were computed on the basis of 100 percent for the total bulk, or volume, of food in the stomach, and the gravel percentage was determined on the basis of 100 percent for the gross stomach contents. The method

is described in detail by Cottam (1936)¹ in a leaflet that may be obtained from the Bureau free on request.

Of the 801 stomachs, 792, being a quarter or more full, were deemed suitable for use in the tabulation of food percentages. A stomach was considered full if its gross contents (food and all other material) totaled 10 cc. or more. The relative volumes of the gross contents of 751 of the stomachs are shown in figure 2. Of the 792 stomachs,



FIGURE 2.—Relative volumes of the gross contents of 751 American coot stomachs.

15 were those of juveniles, included to provide a more nearly complete picture of the food habits, as their diet was similar to that of the adults—differing mainly in the quantity of the various items consumed—and provided needed data for the summer months. The food of the juveniles as a group is treated separately on pages 39 to 43.

The distribution of the tabulated stomachs by months was as follows: January, 123; February, 39; March, 48; April, 49; May, 34; June, 14; July–August,² 36; September, 75; October, 172; November, 97; and December, 105, from which it is seen that the fall and winter months were especially well represented.

¹ Years in parentheses refer to Literature Cited, p. 51.

² The 7 stomachs collected in August were tabulated with the 29 taken in July, as it was not considered desirable to base a month's tabulation on so few stomachs.

The localities in which the 792 stomachs were collected and the number of stomachs taken in each are given, by food regions (p. 43), in the list below and are shown graphically in figure 3.

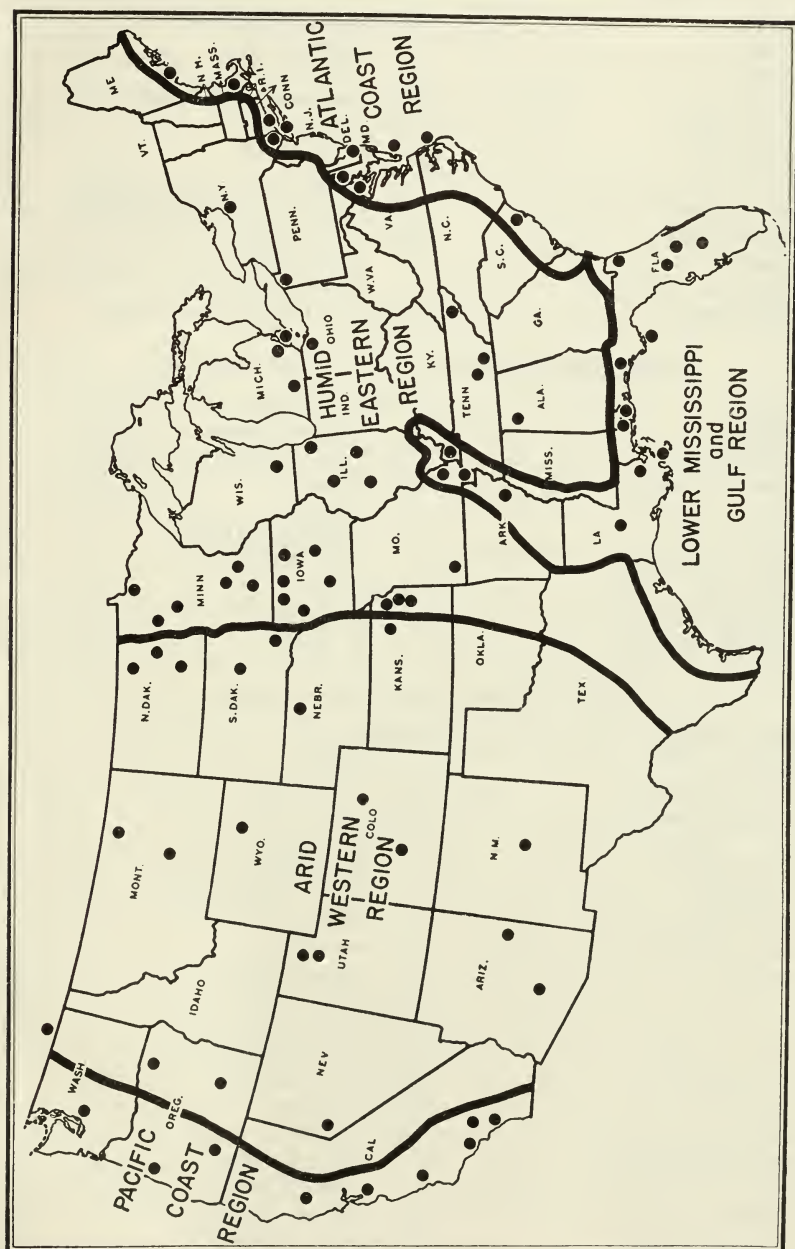


FIGURE 3.—Food regions of the United States and collecting localities of 792 American coot stomachs.

Collecting localities, by food regions, of 792 American coot stomachs and the number of stomachs taken in each

ATLANTIC COAST REGION (269 STOMACHS)

| | | | |
|---------------------------------------|---|--------------------------------------|-----|
| Connecticut: | | Maryland—Continued. | |
| Cheshire..... | 1 | Marshall Hall..... | 1 |
| Derby..... | 1 | Waldorf..... | 1 |
| Middletown..... | 4 | Massachusetts: Wakefield..... | 1 |
| New Britain..... | 1 | New York: | |
| Stratford..... | 1 | Long Island..... | 2 |
| Delaware: Ocean View..... | 1 | Ossining..... | 1 |
| District of Columbia: Washington..... | 8 | North Carolina: Currituck Sound..... | 234 |
| Maine: Westbrook..... | 1 | South Carolina: | |
| Maryland: | | Santee Club..... | 2 |
| Baltimore County..... | 4 | South Island..... | 2 |
| Cecil County..... | 2 | Virginia: Chincoteague Island..... | 1 |

LOWER MISSISSIPPI AND GULF REGION (115 STOMACHS)

| | | | |
|-------------------------|----|-------------------------|----|
| Alabama: | | Florida—Continued. | |
| Mobile..... | 1 | Walton County..... | 8 |
| Orange Beach..... | 7 | Kentucky: Fillmore..... | 1 |
| Arkansas: Menasha..... | 2 | Louisiana: | |
| Florida: | | Avoyelles..... | 5 |
| Amelia Island..... | 7 | Mississippi Delta..... | 9 |
| Lake Okeechobee..... | 5 | New Orleans..... | 32 |
| Micanopy..... | 20 | Missouri: | |
| St. Vincent Island..... | 6 | Little River..... | 1 |
| Seminole County..... | 10 | St. Louis..... | 1 |

HUMID EASTERN REGION (265 STOMACHS)

| | | | |
|-------------------------|----|---------------------------|-----|
| Alabama: Leighton..... | 1 | Michigan: | |
| Alberta: | | Monroe..... | 1 |
| Athabaska Delta..... | 3 | Vicksburg..... | 5 |
| Fort McMurray..... | 2 | Minnesota: | |
| Illinois: | | Blue Earth..... | 2 |
| Cass County..... | 1 | Elk River..... | 2 |
| Chicago..... | 2 | Lake of the Woods..... | 1 |
| Galesburg..... | 1 | Minneapolis..... | 5 |
| Schuyler County..... | 1 | Moorhead..... | 1 |
| Urbana..... | 9 | Pelican Rapids..... | 11 |
| Iowa: | | Missouri: Neosho..... | 29 |
| Clay County..... | 22 | New York: Sodus Bay..... | 1 |
| Crystal Lake..... | 3 | Ohio: Port Clinton..... | 1 |
| Floyd River..... | 1 | Ontario: Windsor..... | 3 |
| Huxley..... | 5 | Pennsylvania: Erie..... | 7 |
| Marshalltown..... | 1 | Tennessee: | |
| Palo Alto County..... | 4 | Chickamauga..... | 1 |
| Kansas: | | Roane County..... | 1 |
| Douglas County..... | 3 | Unicoi County..... | 1 |
| Franklin County..... | 3 | Wisconsin: Marquette..... | 130 |
| Leavenworth County..... | 1 | | |

ARID WESTERN REGION (78 STOMACHS)

| | | | |
|---------------------------------|----|------------------------|----|
| Arizona: | | North Dakota: | |
| Lake Picacho..... | 1 | Grafton..... | 1 |
| Marsh Lake..... | 2 | Rush Lake..... | 3 |
| British Columbia: Okanagan..... | 18 | Stump Lake..... | 2 |
| Colorado: | | Oregon: | |
| Barr..... | 1 | Lake Malheur..... | 26 |
| Gunnison County..... | 2 | Umatilla..... | 1 |
| Kansas: Onaga..... | 1 | South Dakota: | |
| Montana: | | Aberdeen..... | 1 |
| Bowdoin..... | 2 | Clay County..... | 1 |
| Roundup..... | 1 | Utah: | |
| Nebraska: Cherry County..... | 1 | Bear River..... | 6 |
| Nevada: Pyramid Lake..... | 1 | Salt Lake City..... | 1 |
| New Mexico: Elephant Butte Lake | 5 | Wyoming: Sheridan..... | 1 |

PACIFIC COAST REGION (65 STOMACHS)

| | | | |
|-----------------------|----|---------------------------|----|
| California: | | California—Continued. | |
| Los Banos..... | 3 | Watsonville..... | 15 |
| Maxwell..... | 22 | Oregon: | |
| Riverside County..... | 1 | Klamath Falls..... | 6 |
| San Diego..... | 5 | Tillamook..... | 7 |
| San Francisco..... | 5 | Washington: Puyallup..... | 1 |

FOOD HABITS OF THE AMERICAN COOT

In feeding, the coot is primarily a dabbler and grazer, picking up its food from or from near the surface of the water and often from along the shore (pl. 3), occasionally even venturing rather far inland in search for it; but it is a fine diver as well. Forbush (1912, p. 223) says that it "sometimes almost equals the famous Canvas-back in diving for the roots of the wild celery," and Evermann (1902) tells of its diving to a depth of 25 feet to obtain food.

That the coot, as generally described, is an omnivorous feeder may be seen from table 4, pages 33 to 39, which lists in systematic order every food found in the 792 stomachs tabulated, the volumetric percentage it formed of the total food, and the number of stomachs in which it was noted. The number of individual food items in the stomachs varied greatly but averaged more than 4 to a stomach. A coot from Ohio had eaten as many as 23 kinds of food, whereas others from various regions had fed on single forms exclusively.

Apparently by far the larger part of this omnivorous diet is derived from the vegetable kingdom, as plant items averaged 89.39 percent of the food and animal items, although taken as frequently and in as great or greater variety, only 10.61 percent. The preponderance of plant over animal food in the diet is shown by months in table 1.

TABLE 1.—*Summary, by months, of the food and gravel content, expressed by volumetric percentages, of 792 American coot stomachs*

| Month | Stomachs | Food material | | Gravel |
|--------------------------------|---------------|----------------|----------------|----------------|
| | | Plant | Animal | |
| | <i>Number</i> | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> |
| January..... | 123 | 99.92 | 0.08 | 42.81 |
| February..... | 39 | 96.51 | 3.49 | 32.05 |
| March..... | 48 | 95.79 | 4.21 | 33.98 |
| April..... | 49 | 87.24 | 12.76 | 36.71 |
| May..... | 34 | 80.29 | 19.71 | 32.62 |
| June..... | 14 | 78.43 | 21.57 | 25.79 |
| July-August ¹ | 36 | 55.86 | 44.14 | 12.31 |
| September..... | 75 | 96.88 | 3.12 | 30.37 |
| October..... | 172 | 96.98 | 3.02 | 37.73 |
| November..... | 97 | 96.54 | 3.46 | 44.39 |
| December..... | 105 | 98.83 | 1.17 | 34.26 |
| Total or average..... | 792 | 89.39 | 10.61 | 33.00 |

¹ July and August combined (footnote 2, p. 6).

The main food groups and their volumetric percentages are listed below, and the individual foods comprising the groups are discussed in the sections on plant and animal foods.

Main food groups, arranged in order of volumetric percentages, in the diet of 792 American coots

| | <i>Percent</i> |
|--|----------------|
| Plant food | 89.39 |
| Najadaceae (pondweed family)..... | 40.64 |
| Cyperaceae (sedge family)..... | 13.73 |
| Algae (filamentous algae and muskgrasses)..... | 13.70 |
| Gramineae (grass family)..... | 8.22 |
| Ceratophyllaceae (hornwort family)..... | 2.10 |
| Lemnaceae (duckweed family)..... | 1.55 |
| Hydrocharitaceae (frogbit family)..... | 1.43 |
| Pontederiaceae (pickerelweed family)..... | .86 |
| Juncaginaceae (arrowgrass family)..... | .70 |
| Sparganiaceae (burreed family)..... | .49 |
| Other plant food..... | 5.97 |
| Animal food | 10.61 |
| Insecta (insects)..... | 7.24 |
| Mollusca (mussels and snails)..... | 2.95 |
| Arachnida (spiders)..... | .22 |
| Crustacea (crustaceans)..... | .12 |
| Vertebrata (fishes and amphibians)..... | .02 |
| Other animal food..... | .06 |

A few items other than food were found in the stomachs, namely, gravel, coot feathers, and lead shot.

Gravel (including fine sand), which aids greatly in grinding the food a process for which the coot's heavy muscular stomach is well adapted, was found in all but 7 of the 792 stomachs, averaging 33 percent of the gross contents. The percentage was not constant for any one locality or season (pls. 4-7) but ranged from as much as 100 percent in some stomachs to just a trace in others. The percentages are summarized graphically in figure 4 and are given for each month in table 1.

Coot feathers, usually in minute fragments, were found in many stomachs, probably having been ingested during preening. No feathers of other birds were detected.

Lead shot was noted in 12 stomachs, usually only 1 pellet in a stomach, although 2 were found in 1 stomach, 3 in another, and 4 in each of 2 others. The comparative rarity of this item in the coot stomachs is consistent with its rarity among the other birds of this order, as noted by Jones (1939), and is in direct contrast to its high frequency among ducks and other waterfowl, as reported by Pirnie



FIGURE 4.—Volumetric percentages of gravel in the gross contents of 792 American coot stomachs, 7 of which contained none. Traces are included with zero.

(1935), Shillinger and Cottam (1937), and Cottam (1939). The number of pellets ingested by individual coots was also much lower than the average for ducks. Wetmore (1919) says that ducks commonly sift the ooze at the bottom in search of food and in so doing take in lead pellets along with their food, as they seem to swallow any hard object they happen upon. Coots, on the other hand, as previously stated, usually dabble along the surface, and even when they do dive, cannot sift the ooze with their chickenlike bills. It is doubtful whether poisoning from ingested lead is a serious menace to them.

PLANT FOOD—89.39 PERCENT

That the coot is primarily a vegetarian is well demonstrated in this study, as practically nine-tenths of the diet consisted of plant food, which was taken, moreover, in every month and in every locality. Only 1 stomach, that of a nestling from Utah, contained no trace of plant material, whereas 558 stomachs contained vegetation exclusively and a number only a trace of animal matter.

Other investigators also have referred to the coot as primarily a vegetable feeder. Byrne (1879) reported that "a careful examination of the contents of a great many of their gizzards (though in the fall of the year only) has never shown the least particle of animal substances in any of them"; Pirnie (1935, p. 150) detected no animal material whatever in any of 24 stomachs (chiefly fall specimens) examined in the field; and Warren (1888, p. 32) stated:

In March, 1885, I obtained 17 Coots at Little Lake George, Fla., and found in the stomachs of all only small seeds, blades of grass, with, in most every instance, a small quantity of sand or gravel. Six of these birds, which I have obtained in Chester County, Pa., had only vegetable materials, small black and yellow seeds, also sand in their muscular gizzards.

Foreign investigators have found that other species of the genus *Fulica* also feed largely on vegetation. Collinge (1936), for instance, reported that more than 80 percent of the food in 157 stomachs of the European coot (*F. atra atra*) was of vegetable origin.

Although in this study some plant debris (3.38 percent) that could be classed only as unidentified vegetation, usually because of its finely ground condition, was found in the stomachs, 40 families and 78 genera of plants, mostly marsh and aquatic varieties,³ were identified. The bulk of this material was in the form of foliage, stems, or fleshy rootstocks, although seeds were found in numerous stomachs, sometimes forming quite a large percentage of the food. One stomach from Florida contained little but seeds (pl. 4).

The more important plant groups, or those that contributed 1 percent or more each of the total diet, aggregated 81.37 percent. The pondweeds, by far the most commonly taken in this category, furnished practically half the percentage; the sedges and algae, each a trifle more than a sixth; the grasses, about a tenth; and the hornwort, duckweed, and frogbit families, each a fortieth or less.

The plant groups that furnished less than 1 but more than 0.1 percent each of the entire food totaled but 4.41 percent. Either locally popular or taken in small numbers fairly often, they comprised the pickerelweed, arrowgrass, burreed, madder, waterlily, waterplantain, pulse, cattail, watermilfoil, convolvulus, and buckwheat families and the ferns and fern allies.

³ The common names of marsh and aquatic plants used in this bulletin are according to Hotchkiss (1936).

The plant families that supplied less than 0.1 percent or a trace each of the total food aggregated but 0.23 percent and contributed many items in fewer stomachs. Most of them were taken casually; some, only in special localities, as the leaves and stem particles of bald cypress (*Taxodium distichum*), noted only in stomachs from the cypress swamps of eastern Arkansas, as was reported for ducks also, by Mabbott (1920).

A summary, by months, of the main plant food groups, expressed by volumetric percentages, is given in table 2, and the individual foods comprising the groups are discussed in the text.

NAJADACEAE (PONDWEED FAMILY)—40.64 PERCENT

The pondweed family, in which belong the 2 most important single items consumed by the coots examined, the northern naiad and wigeongrass, was without doubt the predominant family in the diet. Pondweeds were eaten in every month and in every section of the United States and were noted in nearly half the 792 stomachs, a percentage roughly approximating the volumetric percentage they furnished of the entire food. In all, 14 species, representing 5 genera, were identified, 7 of them in quantities large enough to be considered important.

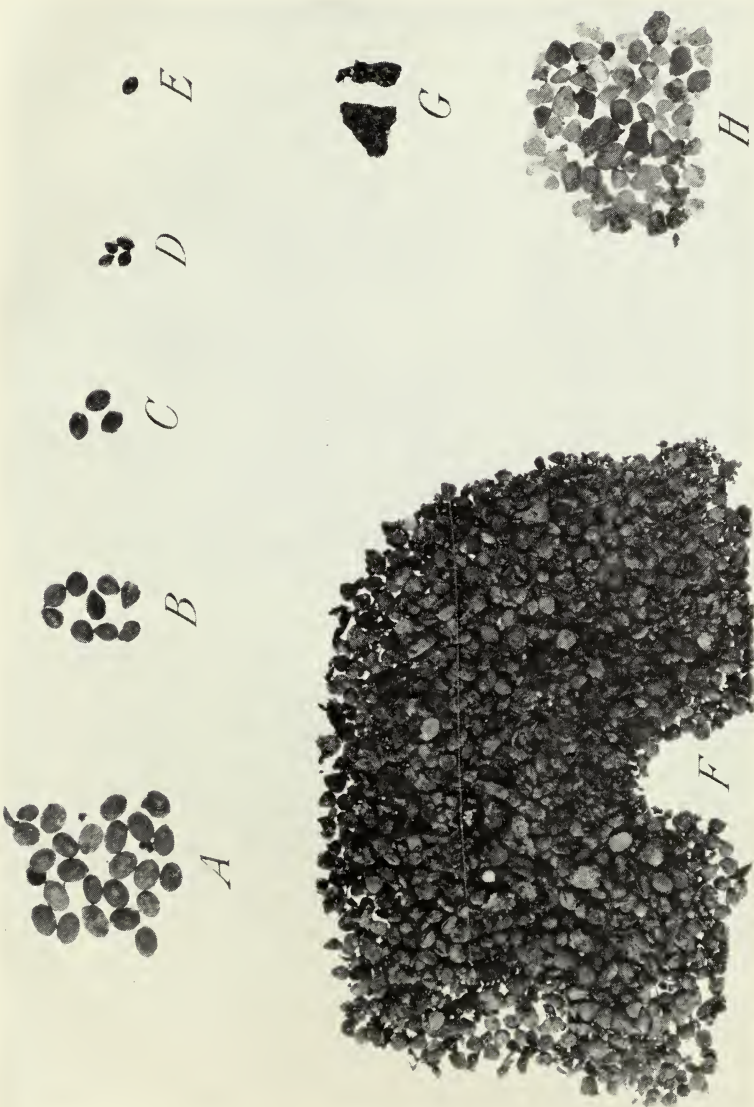
Naiads (19.2 percent).—These excellent aquatics (*Najas*) were found to be the most popular of all foods eaten by the coots, as they supplied a larger percentage of the total diet than any other genus—plant or animal. They were recorded for every month and from all parts of the country, being relatively less important in summer and far more typical of the diet in the eastern and southern than in the western and Pacific areas. They were noted in 414 of the 792 stomachs, in many forming a large part of the food and in many the entire bulk. In 47 stomachs, the determination stopped at the genus; but in the others, *N. flexilis*, which furnished almost three-fourths of the food of the genus, and *N. guadalupensis*, both very popular and eagerly taken wherever found, were identified. These two species are excellent duck food also, as emphasized by Cottam (1939) and Martin and Uhler (1939).

The northern naiad (*Najas flexilis*) was the most important individual item in the diet, as it furnished 14.23 percent of the total food, the largest percentage supplied by any species and nearly twice that contributed by the next most valuable food, wigeongrass (*Ruppia maritima*). It was found in a large series of stomachs from Currituck Sound, N. C., as well as in stomachs from other parts of the Atlantic coast and from many localities in the East and Middle West. Many of the coots had fed exclusively on the leaves and stems, which they had usually chopped up into small fragments; but a few birds had

TABLE 2.—Summary, by months, of the main plant food groups, expressed by volumetric percentages, in the diet of 792 American coots

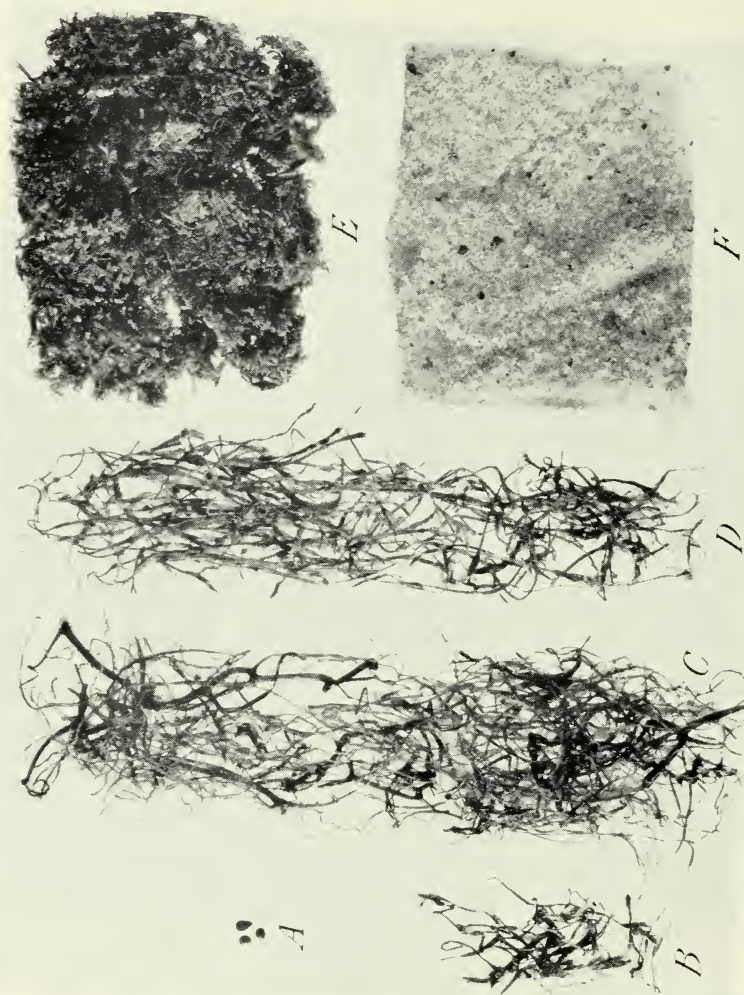
| Item | January | February | March | April | May | June | July-August ¹ | September | October | November | December | Total |
|--|------------------|-----------------|------------------|------------------|-----------------|-----------------|--------------------------|------------------|------------------|------------------|------------------|------------------|
| Stomachs | Number 123 | Number 39 | Number 48 | Number 49 | Number 34 | Number 14 | Number 36 | Number 75 | Number 172 | Number 97 | Number 105 | Number 792 |
| Najadaceae (40.64 percent): | Percent 33.42 | Percent 6.54 | Percent 40.85 | Percent 11.25 | Percent 8.06 | Percent 0.43 | Percent 0.75 | Percent 18.21 | Percent 18.94 | Percent 19.99 | Percent 52.71 | Percent 19.20 |
| Naiads (<i>Najas</i>) | 9.93 | 3.65 | 14.01 | 19.22 | 16.26 | 18.93 | 10.46 | 11.71 | 16.32 | 10.68 | 8.40 | 12.68 |
| Pondweeds (<i>Potamogeton</i>) | 24.18 | 4.59 | 10.25 | 13.43 | 13.62 | | (?) | | .70 | 2.26 | 20.21 | 8.11 |
| Wigeongrass (<i>Ruppia maritima</i>) | 2.27 | | | | 1.17 | | | | | 1.03 | 2.62 | .65 |
| Other pondweeds | | | | | | | | | | | | |
| Cyperaceae (13.75 percent): | | | | | | | | | | | | |
| Bulrushes (<i>Scirpus</i>) | .80 | 4.77 | 3.31 | 10.25 | 8.24 | 22.86 | 13.92 | 8.96 | 13.93 | 5.53 | .36 | 8.45 |
| Spikerushes (<i>Eleocharis</i>) | 1.20 | 14.88 | 4.31 | .10 | 1.00 | 3.00 | 1.39 | 3.10 | 1.23 | 4.71 | | 3.18 |
| Sedges (<i>Cyperus</i> , <i>Carex</i> , etc.) | 1.73 | 10.82 | .19 | 1.57 | .30 | 2.57 | 4.09 | .02 | .83 | .85 | .19 | 2.10 |
| Algae (13.7 percent): | | | | | | | | | | | | |
| Muskgrasses (Characeae) | 4.29 | 11.23 | 10.62 | 6.61 | 7.53 | 11.64 | 2.00 | 20.64 | 11.15 | 13.85 | 10.34 | 9.99 |
| Filamentous algae | .02 | 3.92 | .46 | 7.33 | 4.17 | 7.21 | 7.69 | 1.58 | 5.99 | 2.43 | (?) | 3.71 |
| Gramineae (grasses) | 15.84 | 3.77 | 1.36 | 8.33 | 4.79 | | (?) | 26.73 | 7.23 | 21.65 | .91 | 8.22 |
| Ceratophyllaceae (goonails) | .04 | .26 | 1.75 | .08 | 1.06 | | 13.00 | .02 | 5.79 | .98 | .12 | 2.10 |
| Lemnaceae (duckweeds) | .99 | 6.66 | .17 | | .65 | .36 | | 2.17 | 3.20 | 3.76 | (?) | 1.55 |
| Hydrocharitaceae: Wildeely, waterweeds | .45 | 2.23 | (?) | 1.90 | .29 | | | .91 | 5.56 | 4.23 | .22 | 1.43 |
| Other plant food | 4.76 | 23.19 | 8.51 | 7.17 | 13.15 | 11.43 | 2.56 | 2.83 | 6.11 | 4.59 | 2.75 | 8.02 |
| Total | 99.92 | 96.51 | 95.79 | 87.24 | 80.29 | 78.43 | 55.86 | 96.88 | 96.98 | 96.54 | 98.83 | 89.39 |

¹ July and August combined (footnote 2, p. 6).² Trace, or less than 0.01 percent.



Stomach contents of a coot collected at Micanopy, Fla., January 13, 1910. Volumetric percentages: Plant, 100; animal, trace; gravel, 5. Items ($\times 1\frac{1}{2}$): A, Seeds of the watershield (*Brasenia schreberi*); B, seeds of the swamp bulrush (*Scirpus subterminalis*); C, seeds of the water-lily (*Nymphaea odorata*); D, seeds of the dotted smartweed (*Polygonum punctatum*); E, seeds of the pickerelweed (*Pontederia cordata*); F, seeds of the squarestem spikerush (*Eleocharis quadrangulata*); G, fragments of dragonfly larva (Anisoptera); and H, gravel.

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Stomach contents of a coot collected at Currituck Sound, N. C., January 7, 1910. Volumetric percentages: Plant, 100; animal, 0; gravel, 26. Items (X 1): A, Seeds of wigeon grass (*Ruppia maritima*); B, whole stalks of the sago pondweed (*Potamogeton pectinatus*); C, whole stalks of wigeon grass; D, whole stalks of the southern naiad (*Najas guadalupensis*); E, finely ground fragments of wigeon grass and the southern naiad, the latter predominating; and F, gravel.

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eaten whole tufts of plants. Roots were taken casually; seeds, rarely and probably in most instances incidentally, as in only 1 stomach did they form as much as 1 percent of the food. It is interesting to note that the stomachs from Currituck Sound were obtained prior to 1919, when pollution and excessive salinity first began to take toll of the aquatics on this fine wild-fowl wintering ground. Bourn (1932) gives an excellent account of the pollution of this area and the simultaneous disappearance of practically all the aquatic seed plants.

The southern naiad (*Najas guadalupensis*) (pl. 5, *D* and *E*), identified in 73 stomachs from North Carolina, Florida, Louisiana, and a few scattered localities of the Atlantic coast and the West, replaced to a great extent the northern naiad in the parts of the country beyond the normal range of the latter. It is usually more slender than the northern species and has a slightly different leaf construction and noticeably different seeds. The latter are small and dull, with coarse reticulations; those of *N. flexilis* are about twice as large, and shiny, with fine reticulations.

Potamogeton (12.68 percent).—Pondweeds of the genus *Potamogeton* were noted in many stomachs, representing almost equally every month. In 169 stomachs the fragmentary remains could be designated only as belonging to the genus (pl. 6, *C*); but in the others, 9 species were identified.

The sago pondweed (*Potamogeton pectinatus*), the most frequently consumed, was eaten by 249 birds, by many exclusively. Both the vegetative parts and the seeds were taken, sometimes by the same bird. The leaves, stems, and also the roots were used, as a result, apparently, of the birds having dived, pulled up the whole plant, and then snipped off and eaten the parts at their leisure. Occasionally the whole plant was swallowed (pl. 5, *B*). Seeds (pl. 6, *E*) were consumed quite commonly but rarely amounted to more than a small proportion of the individual stomach content. The longleaf pondweed (*P. americanus*) was identified in 37 stomachs. In some cases the leaves were eaten; more often, the seeds (pl. 7, *D*). Seeds, however, did not contribute a large percentage in any stomach, but leaves formed the bulk of the contents in several. Leaves, stems, and seeds of *P. foliosus* were identified in 15 stomachs.

Each of the other 6 *Potamogeton* species identified furnished less than 1 percent of the total food. Seeds of *P. pusillus* (pls. 6, *F*; 7, *C*) amounted to quite a large percentage in some of the 35 stomachs in which found. Leaves of the flatstem pondweed (*P. zosteriformis*) formed more than three-fourths of the contents of a stomach from northern Alberta. Seeds of the variableleaf pondweed (*P. gramineus*) were noted in 5 stomachs. The claspingleaf pondweed (*P. perfoliatus*) was taken in small quantities by 35 coots, most of the per-

centage being formed by leaves and stems, the small seeds usually contributing but a trace. The pondweed *P. lucens* was noted in 1 stomach, from California, and seeds of the floatingleaf pondweed (*P. natans*), in 3 stomachs.

Wigeongrass (8.11 percent).—Wigeongrass (*Ruppia maritima*) was well liked, as it furnished the second largest food percentage of any species in the diet, only the northern naiad (*Najas flexilis*) supplying a larger. It was taken by 240 coots, chiefly in the Atlantic Coast and Gulf States and occasionally in parts of the Middle West, many of which had eaten it exclusively. All parts of the plant served as food: parts of leaves, stems, and now and then roots were snipped off and eaten (pl. 5, *E*); whole plants (pl. 5, *C*) were consumed by a few birds; and the small black seeds (pl. 5, *A*) often formed a large percentage of the contents of a stomach. Many small immature seeds were found in several stomachs from Louisiana, 1 of which contained nothing but the seeds (735 whole ones and a few fragments) and a few vegetative fragments; another, 685 seeds; and 7 others, more than 200 seeds each. McAtee⁴ told of a coot shot at Nantucket, Mass., on February 17, 1907, that had fed exclusively on *R. maritima*, many fragments of the plant and one seed having been found in the stomach.

Eelgrass (0.54 percent).—Eelgrass (*Zostera marina*), a widely distributed marine plant, was noted in 25 stomachs collected on the Atlantic and Pacific coasts in November, December, and January. Occasionally it was represented in the stomach by chopped-up fine fragments, but often by long strands of the wide leaves. In comparison with the other groups of the pondweed family it cannot be ranked as an important food, but this may be due to the preference of coots for fresh or slightly brackish waters rather than for the normal salt-water habitat required by eelgrass. Inasmuch as a large number of the stomachs were collected before the disappearance of most of the eelgrass from the Atlantic coast, it must be concluded that this important food of certain waterfowl is not particularly valuable to coots.

Horned pondweed (0.11 percent).—The horned pondweed (*Zannichellia palustris*) was found in only one stomach, taken in Missouri, in which it made up more than one-third of the contents. Only the leaves were consumed. This plant is only locally abundant and is probably acceptable as food, though evidently not sought.

CYPERACEAE (SEDGE FAMILY)—13.73 PERCENT

The sedges, as a family, ranked second in value in the diet of the coot, comparing favorably with the pondweeds, algae, and grasses as a popular food. Remains of 26 species of 7 genera, with *Scirpus* by

⁴ McAtee, W. L.: Field notes, March 4, 1907.

far the most important, were identified in stomachs collected from all parts of the United States and in every month. All parts of the plants—leaves, stems, occasionally roots, and very often seeds—were eaten.

Bulrushes (8.45 percent).—Bulrushes (*Scirpus*) formed the third largest percentage of any plant genus in the food of the coots. They were found in about a third of the stomachs, in many exclusively, and were taken in substantial quantities in every month and in every region of the United States. All parts of the plants served for food, but the leaves, stems, and seeds were the most popular. In 56 stomachs the leafy parts had been ground up to such an extent that recognition beyond the genus was impossible; but in the others, 8 species were identified.

The best-liked of all the *Scirpus* species appeared to be the hard-stem bulrush (*S. acutus*), as it was found in 162 stomachs, was consumed in every month, and contributed practically half the food of the genus. Both the leafy vegetative parts and the small black seeds were taken, often in large quantities (pl. 6, *D* and *I*). Most of the records came from the Middle West and from across the northern part of the United States, showing that the plant is favored over its entire range and is entitled to recognition as one of the important foods of the coot.

The other *Scirpus* species taken were relatively unimportant. The common three-square (*S. americanus*) (pl. 7, *A*), the river bulrush (*S. fluvialis*), the southern bulrush (*S. californicus*), the softstem bulrush (*S. validus*) (pl. 7, *E*) and the alkali bulrush (*S. paludosus*), found in 27, 19, 7, 9, and 5 stomachs, respectively, each contributed less than 0.5 percent of the total food. The slender bulrush (*S. heterochaetus*), noted in 9 stomachs, and the swamp bulrush (*S. etuberculatus*), found in 1 from Florida (pl. 4, *B*), supplied but a trace each. The seeds of the common three-square were consumed more often than its other parts, and the seeds only of the other species were taken.

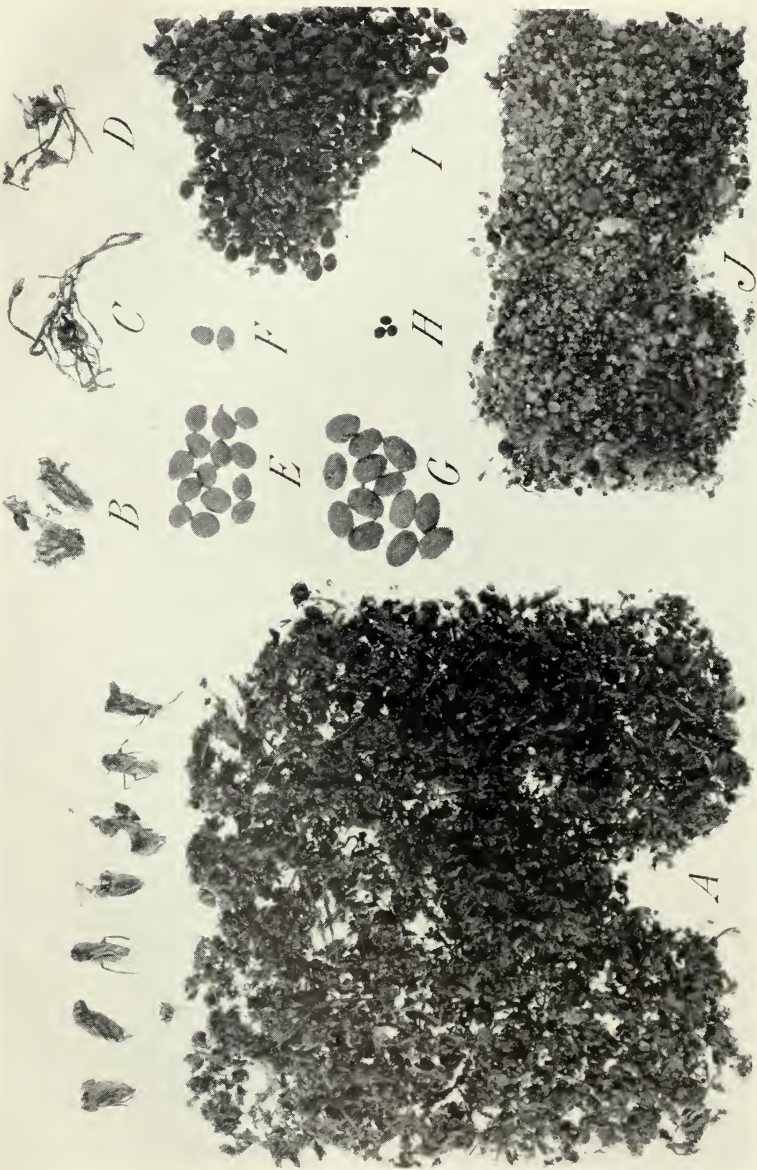
Spikerushes (3.18 percent).—Although spikerushes of the prominent *Eleocharis* genus of the sedge family did not form a very important contribution to the food of the coots, they were certainly of more than casual significance and probably should be regarded as a well-liked group of secondary value, supplementary to the more popular foods. They were eaten by 62 individuals that represented every month except December. In 50 stomachs identifications were concluded with the genus; but in the others, 5 species were recognized. The seeds and often the stems and leaves were taken, and several coots from Florida that had fed on spikerushes exclusively had gulped down whole tufts. Stalks of the slender spikerush (*E. acicularis*) were found in 3 stomachs, furnishing four-fifths of the contents of 1 from Florida. Seeds were

noted as follows: Those of *E. prolifera* in 3 stomachs, forming four-fifths of the contents of 1 from Micanopy, Fla.; those of the common spikerush (*E. palustris*), in 4; 770 of those of the squarestem spikerush (*E. quadrangulata*), in 1 from Micanopy, Fla., composing most of the contents (pl. 4, *F*); and those of the spikerush *E. olivacea*, in 1, amounting to only a trace.

Cyperus and allies (1.22 percent).—Seeds and occasionally leafy vegetation of plants of the genus *Cyperus* were noted in 18 stomachs collected mostly in fall and winter. In 13 stomachs the identification of the small vegetative fragments and many of the small seeds was doubtful beyond generic characterization; but in the others, 4 species were determined. Of these, the following 3 furnished small percentages of the total food: *C. ferax*, found exclusively in 2 stomachs from Florida; *C. erythrorhizos*, seeds of which formed a large part of the contents of a stomach from California; and *C. flavescentes*, seeds of which were found in a single stomach. A trace of the total food was supplied by seeds of *C. diandrus*, noted once. Two other sedge species belonging to genera closely allied to *Cyperus* furnished traces of the total diet as follows: Seeds of *Dulichium arundinaceum* contributed a small percentage of the contents of a stomach collected in Minnesota in May and those of *Kyllinga pumila* were noted in a stomach from Iowa.

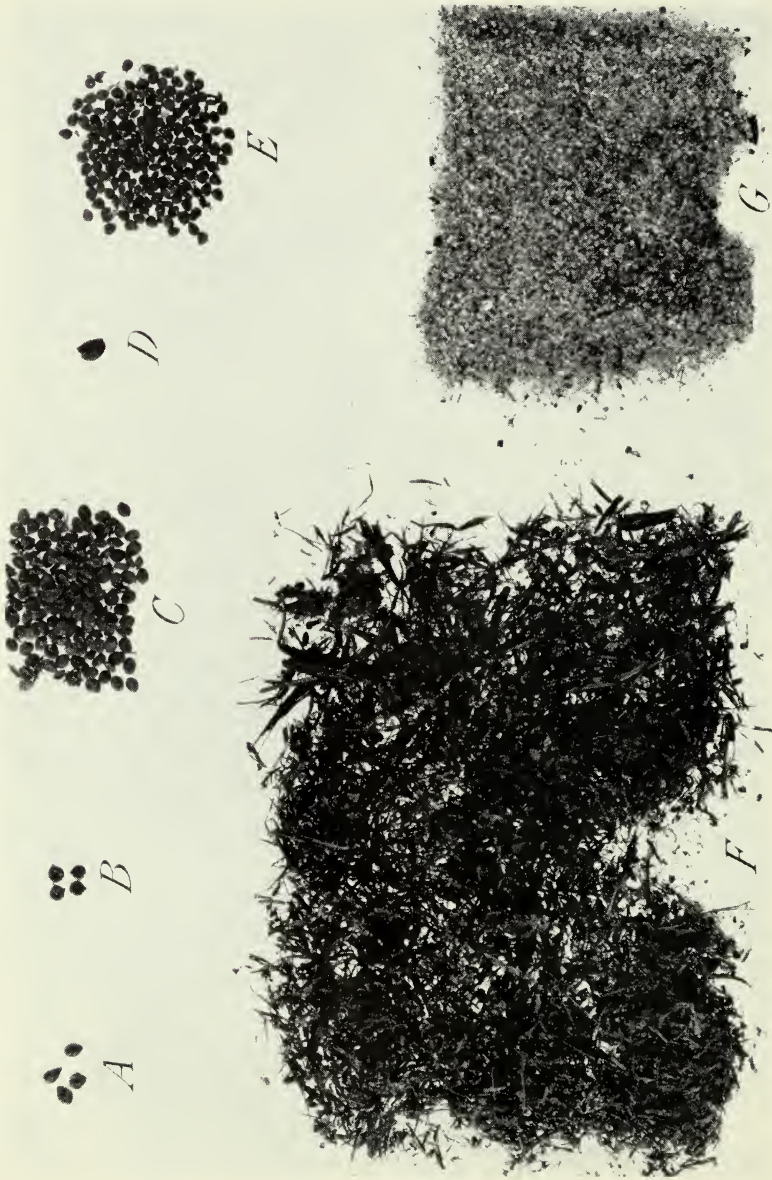
Carex (0.81 percent).—Although species of *Carex* were unimportant in the diet, they were consumed occasionally throughout the range of the coot, all sections of the country and nearly every month being sparingly represented. In only 5 of the 63 stomachs in which found did they supply more than a small percentage of the contents, but in these the leaf and stem particles formed the food material. Usually the seeds were eaten, and they almost invariably supplied but a small proportion of a stomach's contents. Because many of the 500 or more North American *Carex* species have seeds that are extremely difficult to tell apart, in 46 stomachs identifications were terminated with the genus. In 17 stomachs, however, 5 species were recognized. Of these, only seeds of *C. lacustris*, appearing in 13 stomachs, mostly from Iowa, furnished a percentage of the total food. The other 4 supplied mere traces and were noted as follows: Seeds of *C. filiformis*, in 5 stomachs, in none contributing as much as 1 percent of the food; and seeds of *C. lupuliformis*, *C. lupulina*, and *C. tribuloides*, in 1 stomach each.

Mariscus (0.07 percent).—Plants of the genus *Mariscus*, consumed by 16 coots, furnished a percentage of the monthly food in January and March only but appeared as traces in the diet in May and October. Seeds alone were taken, 392 by a coot from Louisiana; 374 and 87 by 2 coots from Florida; and smaller quantities, usually forming but a trace of the meal, by 13. Identifications had to be terminated with



Stomach contents of a coot collected at Bowdoin, Mont., July 8, 1919. Volumetric percentages: Animal, 88; plant, 12; gravel, 17. Items (× 11): A, water boatmen (*Acrosticta*), whole and fragments; B, wings of dragonflies (*Anisoptera*); C, pondweed leaves (*Potamogeton*); D, hardstem bulrush (*Scirpus acutus*); E, seeds of the sago pondweed (*P. perfoliatus*); F, pondweed seeds (*P. pusillus*); G, seeds of the coontail (*Ceratophyllum demersum*); H, seeds of the dodder (*Cuscuta*); I, seeds of the hardstem bulrush; and J, gravel.

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Stomach contents of a coot collected at Marquette, Wis., September 21, 1909. Volumetric percentages: Plant, 100; animal, 0; gravel, 28. Items (X 1½): A, Seeds of the common three-square (*Scirpus americanus*); B, seeds of the nodding smartweed (*Polygonum lapathifolium*); C, seeds of a pondweed (*Potamogeton pusillus*); D, seeds of the longleaf pondweed (*P. americanus*); E, seeds of the softstem bulrush (*S. validus*); F, shredded hulls and seeds of wildrice (*Zizania aquatica*); and G, gravel.

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the genus in 5 stomachs; but sawgrass (*M. jamaicensis*), which supplied most of the percentage for the genus, was identified in 9 and *M. mariscoides*, which furnished only a trace of the food, in 2, in neither forming as much as 1 percent of the meal.

ALGAE—13.7 PERCENT

Muskgrasses (9.99 percent).—Taken in every month and in all parts of the United States by more than a third of the coots examined, muskgrasses (Characeae) ranked third of the 4 most important coot foods. Two genera, *Chara* and *Nitella*, were recognized, but as the various species of these genera are difficult to distinguish, no attempt to identify specimens beyond the genus was considered practicable. In 15 instances in which even the genus was in doubt the name Characeae was used. Identified in 193 stomachs that represented every month, *Chara* formed an important part of the diet, being most commonly used for food along the Atlantic coast, in the Great Lakes region, and in southern British Columbia. In many instances it was taken exclusively, although more often it was consumed along with several other plant species. The oögonia were often noted and in each of several stomachs from Currituck Sound, N. C., numbered more than a thousand. The much more delicate *Nitella* was not so popular. Found in 77 stomachs, it was consumed chiefly along the Atlantic coast and was favored in no particular season. Pirnie (1935, p. 217) reports coots feeding extensively on muskgrass in Michigan lakes.

Filamentous algae (3.71 percent).—These algae, including the blue-green and green types, so commonly inhabiting fresh-water streams and lakes, were found to be important food items in the diet of the coot, their presence having been recorded in the stomachs of 93 birds collected from all parts of the United States. Although in most stomachs the algal forms were found in conjunction with some other kind of food, in some they supplied the entire contents. It was not considered practicable to attempt close identification of these primitive forms.⁵

Other investigators also have reported algae useful as food of the bird. Byrne (1882) describes the coot as "entirely a vegetable feeder, feeding principally on fresh water algae, mosses, weeds, and other aquatic plants and reeds." King (1883, p. 603) states of the species in Wisconsin: "Of two specimens examined only algae were noted as occurring in the stomachs." Wetmore (1920, p. 396) writes of his

⁵ Paul S. Conger, of the Carnegie Institute of Washington, D. C., identified 26 species of diatoms taken from a stomach collected in Missouri. Traces of desmids and diatoms were noted in 3 other stomachs, from Florida, but no attempt was made generally to determine the presence of these microscopic algae, as their size renders them valueless as food unless taken in enormous quantities.

observations of the bird at Lake Burford, N. Mex.: "One bird was seen eating algae and slime that had collected on dead tule stems floating in the water. It fed eagerly on this material, seizing and stripping one piece after another."

GRAMINEAE (GRASS FAMILY)—8.22 PERCENT

Grasses were fairly important in the food of the coots studied, ranking fourth as a group. They were eaten by birds collected in all parts of the country and in every month. In 26 stomachs the vegetative parts were too heavily digested or were in fragments too small to permit identification beyond the family; but in the other stomachs 16 genera were recognized. The grasses eaten fall into two main classes, wild grasses and cultivated grains, the former appearing slightly more important. The economic aspect of the coot's feeding upon cultivated plants is discussed later (p. 49), when both grains and other crops are treated. Only their relative importance is reported here.

The most favored grass was wildrice (*Zizania aquatica*) (pl. 7, F), which was identified in 41 stomachs, mostly in a large series from Wisconsin but also in some collected in the South and the East. A number of birds had made it the bulk of their meal, and several had fed exclusively on its seeds and hulls. Most of it was taken in fall, when the seeds were ripe, although a generous portion of it was included in the food of several coots taken in May and June. As a rule the bulk of the material consisted of seeds, but occasionally the foliage was consumed. Pirnie (1935, p. 147) found that 14 of 24 coot stomachs examined contained wildrice seeds.

Each of the other wild grasses eaten furnished less than 0.4 percent of the total food. Bluegrass (*Poa*) was eaten exclusively by 2 coots from Louisiana. Wild millet (*Echinochloa crusgalli*) was consumed by 13 birds, 1 from Illinois and 12 from California, several of which had made it more than a third of their meal and 1 more than three-fourths. Apparently the leaves were not relished, as only the seeds were found. Crabgrass (*Digitaria*) was found in 3 stomachs collected in fall, 2 in Missouri and 1 in California. Saltgrasses were represented by *Distichlis* sp. in 4 stomachs and by *D. stricta* in 1, composing the entire contents of 2. Panic grass (*Panicum*) was found in 2 stomachs. The rather harsh broomsedge, represented by *Andropogon* sp. in 1 stomach from Alabama and by *A. virginicus* in 1 from Tennessee, amounting to but a trace in each, should be considered extremely casual or even accidental in occurrence. Paspalum (*Paspalum*), pigeongrass (*Setaria viridis*), giant cutgrass (*Zizaniopsis miliacea*), rice cutgrass (*Leersia oryzoides*), whitegrass (*L. virginica*), and lovegrass (*Eragrostis*), each found but once or twice and amounting to a mere trace of the total food, were all casual and unimportant.

Oats (*Avena sativa*), the second most important grass in the diet, were identified in 34 stomachs from the Middle West, Oregon, and California, in most of them contributing a large proportion of the contents. Of 25 stomachs collected at Malheur Refuge, Oreg., 23 contained varying amounts of this grain, which had been distributed about the shore to attract birds for banding purposes and as food for ducks. It is interesting to note that it apparently was well liked when obtainable in this form but rarely was sought in grainfields. As only 11 other stomachs contained oats, usually in small quantities, the inference might be drawn that under ordinary circumstances this grain is not sought by the coots but when conveniently available is readily consumed.

Rice (*Oryza sativa*), which ranked third of the grasses in value, was identified in 21 stomachs, all from the rice-growing districts of California, in some of which it composed the entire meal, although in many it was found along with other foods. Although it supplied but 1.52 percent of the total diet, it appears to be popular locally, as it furnished 27.63 percent of the food of the Pacific Coast Region.

Two other cultivated grains were noted. Rye (*Secale cereale*), found in one stomach, furnished a very small percentage of the total food; and wheat (*Triticum aestivum*), found in two, a mere trace.

CERATOPHYLLACEAE (HORNWORT FAMILY)—2.1 PERCENT

The coontail (*Ceratophyllum demersum*) seems to have been equally favored along with most other submerged aquatics, as it was eaten by 56 coots taken in all months and in all regions of the United States. The widespread distribution of acceptances seems to indicate a more than local preference for the plant. In many instances the large brown seeds were taken (pl. 6, *G*), being popular with a number of individuals from California and Iowa, but they were seldom consumed in large quantities. The largest percentages were furnished by the dissected submerged leaves. These formed the entire meal of 5 birds and at least half the meal of several more.

LEMNACEAE (DUCKWEED FAMILY)—1.55 PERCENT

Duckweeds proved to be a fairly popular supplementary food. Taken in all seasons and in every region, they were most favored in fall and winter by coots collected in the Mississippi Valley region. Usually the quantities taken were small; rarely they formed the bulk of a meal. In 12 stomachs the identification was recorded merely as *Lemna* sp.; but in the others, 4 species were determined. Of these, 3 furnished small percentages of the food and were noted as follows: *L. minor*, in 27 stomachs; star duckweed (*L. trisulca*), in 15, mostly from the Middle West and collected largely in fall; and big star duckweed

(*Spirodela polyrhiza*), in 8, forming two-thirds of the food contents of 1 from Wisconsin. The fourth species, *L. minima*, noted in 3 stomachs, supplied but a trace of the total food.

HYDROCHARITACEAE (FROGBIT FAMILY)—1.43 PERCENT

The evidence disclosed by the present stomach analyses failed to uphold the supposed popularity of wildcelery (*Vallisneria spiralis*) in the coot diet. Found in 69 stomachs from the Atlantic coast, Gulf States, and the Great Lakes region, this plant rarely furnished a large percentage of the food in any stomach and despite its widespread distribution in the eastern United States totaled less than 1 percent of the entire food. Although the leaves were often eaten, the winter buds and occasionally the rootstocks were preferred. Evermann (1902), in an account of the coot at Lake Maxinkuckee, Ind., reports its favorite food to be the modified stolon, or winter bud, of *V. spiralis* and states that after the supply of this choice part is exhausted, the bird feeds upon other parts of the plant and on other plants that it had at first rejected. Bent (1926) remarks that the coot is "very fond of wildcelery;" Forbush (1912) records it as feeding on this plant; and Hollister⁶, in a report from Delavan, Wis., writes: "Coots steal wildcelery from diving ducks and also tear up much of it by their own efforts."

The waterweed *Anacharis canadensis*, the other member of the frogbit family eaten by the coots, was not particularly favored either, although several birds had fed on it exclusively. It was identified in only 22 stomachs, largely from the northern part of the United States from New England to Wisconsin, and in most of these formed but a small percentage of the food. It was usually consumed in large pieces—the stem with several to many leaves attached—which rendered identification fairly easy.

PONTEDERIACEAE (PICKERELWEED FAMILY)—0.86 PERCENT

Members of the pickerelweed family were consumed by 10 coots, with no particular season favored, January, June, September, and October being represented. Both the seeds and leafy vegetation were taken, but the latter was more popular. One individual collected in Florida in June had fed exclusively on the leaves of a pickerelweed (*Pontederia* sp.) and one taken in the same State in winter had eaten a few seeds of *P. cordata* (pl. 4, *E*). Waterstargrass (*Heteranthera dubia*) was consumed by 8 birds taken in Wisconsin and Pennsylvania in fall, all of which had fed on its vegetative parts, 2 exclusively; and according to Pirnie (1935, p. 217) coots observed at Lake Lansing,

⁶ Hollister, Ned. In W. L. McAttee's Field Report, 1908. Biological Survey.

Mich., in fall seemed to prefer this type of food, even though wild-celery and pondweeds were available.

JUNCAGINACEAE (ARROWGRASS FAMILY)—0.7 PERCENT

The arrowgrass *Triglochin maritima* was recorded as forming the entire contents of three stomachs collected at Haywards, Calif., in February. The brackish and alkaline habitats of the plant obviously restrict its use as food by the coot.

SPARGANIACEAE (BURREED FAMILY)—0.49 PERCENT

The important feature of plants of the genus *Sparganium* as food for the coots is the large number of stomachs (50) in which they were found in contrast to the small percentage they supplied of the total food. The latter may be attributed to the fact that the seeds rather than the leafy vegetation were favored and in no stomach formed a large proportion of the contents, often just a trace. Thus, although the seeds are quite acceptable, burreeds rank only as a food of secondary importance. Seeds of the giant burreed (*S. eurycarpum*), which are easily distinguishable from those of other species of the genus, being much larger, more angled, and often 2-celled, were found in 17 stomachs. All the other burreed seeds noted, found in 33 stomachs, were recorded as *Sparganium* sp., as they are so similar it is almost impossible to recognize them specifically. Most of them were quite small, as 30 seeds furnished only 1 percent of the bulk in a full stomach.

RUBIACEAE (MADDER FAMILY)—0.42 PERCENT

The buttonbush (*Cephalanthus occidentalis*) was eaten by eight coots taken in April, May, and June. Leaves of this plant were found in large quantities in a stomach from Maryland and in varying amounts in six stomachs from Missouri, in three of which they comprised more than one-third of the contents; and several seeds were found in a stomach from Illinois.

NYMPHAEACEAE (WATERLILY FAMILY)—0.38 PERCENT

Members of the waterlily family, of which 4 genera and 4 species were recognized, were most prevalent in stomachs collected during the first 5 months of the year, chiefly in the South, although the spatterdock *Nuphar advena* was present in 2 stomachs from Minnesota taken in May and September. Only the seeds were eaten, the vegetative parts seeming to have no appeal. Seeds of the watershield (*Brasenia schreberi*) (pl. 4, A), the most popular of the family, were found in 12 stomachs, 10 from Florida and 1 each from North Carolina and Tennessee. Often they furnished but a small percentage of the

food, but they formed the entire meal of a coot from Florida that had taken 199 and more than a third of that of another that had consumed 112. Seeds of the waterlily (*Nymphaea odorata*) (pl. 4, C) were found in 4 stomachs from Florida but did not contribute a large percentage in any, 87 whole seeds and a few fragments being the largest quantity recorded. Several seeds of spatterdock (*Nuphar* sp.) were identified in a stomach from Florida and of *N. advena* in the two stomachs from Minnesota. The fanwort (*Cabomba caroliniana*) was represented by 18 seeds in a stomach from Florida.

ALISMACEAE (WATERPLANTAIN FAMILY)—0.35 PERCENT

Arrowheads (*Sagittaria*), of which only the leafy parts were eaten, served as grazing food for the coots, and undetermined species of the genus, noted in five stomachs, furnished the entire food percentage for the Alismaceae. The species *S. heterophylla*, identified in two stomachs, and *S. latifolia*, found in one, each contributed only a trace of the diet, as did waterplantain (*Alisma*), noted in two stomachs.

LEGUMINOSAE (PULSE FAMILY)—0.28 PERCENT

Clover leaves identifiable only as *Trifolium* were found in two stomachs collected in California in March, in one exclusively; and leaves of the white clover (*T. repens*) formed a fourth of the contents of a stomach taken in Missouri in April. In each instance the clover had been obtained in a meadow some distance from water, an excellent illustration of the way these birds may wander far from shore in search for food.

TYPHACEAE (CATTAIL FAMILY)—0.25 PERCENT

Cattails (*Typha*) were not a common food, nor can they be very desirable, as from their abundance they could readily have been obtained. They were found in only two stomachs, both from the Mississippi River Delta in southern Louisiana, in each of which they composed a large proportion of the contents. The leafy parts had been consumed to a slight extent, but the long-headed spikes furnished most of the food, a great many of the seedlike fruits with the perianth bristles still attached, being easily discernible.

HALORAGIDACEAE (WATERMILFOIL FAMILY)—0.23 PERCENT

Plants of 3 genera and 3 species of the Haloragidaceae were identified in 14 stomachs collected chiefly in fall; but only the watermilfoil *Myriophyllum spicatum* was a significant food, and even that was casual. Its dissected submerged leaves were eaten by 4 coots taken in Wisconsin in September and October and by 1 collected in Arizona,

forming more than three-fourths of the meal of 1 and more than a third that of 2. Material that could not be identified beyond the genus *Myriophyllum* was found in 4 stomachs. Several seeds of mermaidweed (*Proserpinaca palustris*) were noted in each of 2 stomachs collected in Connecticut and Virginia in fall, and those of marestail (*Hippuris vulgaris*) in each of 2 from central Oregon, forming only a trace of the food in each.

FERNS AND FERN ALLIES—0.18 PERCENT

Although inconsequential in the food of the coots examined, the ferns and fern allies (Pteridophyta) may possibly be popular locally. There were only four stomach occurrences for the group. Horsetail (*Equisetum*) was found in quantity in each of two stomachs from northern Alberta; fronds of the Christmas fern (*Polystichum achrostichoides*) formed about a fifth of the contents of a stomach from the vicinity of Washington, D. C.; and small fragments of the peppermint (*Marsilea vestita*) were noted in one from California. The latter two plants were either extremely casual or else accidental and of no particular importance as food.

CONVOLVULACEAE (CONVOLVULUS FAMILY)—0.14 PERCENT

Tendrils and seeds (pl. 6, *H*) of the vine of dodder (*Cuscuta*), found in five stomachs, formed the entire food percentage for the convolvulus family. Vegetative parts furnished more than half the food in two stomachs from Florida and a small part of that in one from Wisconsin; and several seeds were present in each of two stomachs from Montana. One seed of the bindweed (*Convolvulus*) was noted in a stomach from Alabama, but it supplied only a trace of the total food.

POLYGONACEAE (BUCKWHEAT FAMILY)—0.13 PERCENT

Representatives of the buckwheat family were found in coot stomachs from all regions taken in all seasons, with no particular emphasis on any one place or season. The vegetative parts of these plants were ignored. The little seeds were taken in small numbers and in no instance amounted to a large proportion of the contents of a stomach. Seeds of nine species of two genera of the family were identified, two or more species occasionally being found in the same stomach.

Of the smartweeds (*Polygonum*), 4 determinations were concluded with the genus, but 8 species were recognized. The largeseed smartweed (*P. pensylvanicum*), the water smartweed (*P. amphibium*), and the nodding smartweed (*P. lapathifolium*) (pl. 7, *B*), eaten by 3, 9, and 26 coots respectively, furnished very small percentages of the food. Although the last-named was taken by many more birds than

the others, it formed the smallest percentage, both because its seeds are small and because relatively few of them were taken at one time. The dotted smartweed (*P. punctatum*) (pl. 4, D), the marsh smartweed (*P. muhlenbergii*), *P. opelousanum*, ladysthumb (*P. persicaria*), and the Virginia smartweed (*P. virginianum*), found in 3, 4, 2, 3, and 1 stomach respectively, contributed only traces of the food.

The docks (*Rumex*) also furnished only traces of the diet. Seeds of the golden dock (*R. maritimus* var. *fueginus*) were noted in 4 stomachs, 2 from Iowa and 1 each from North Dakota and Wyoming; and a few seeds unidentified beyond the genus were found in 3 stomachs, 2 from Iowa and 1 from Wyoming.

OTHER PLANT FOOD—0.23 PERCENT

The other plant families identified were of little or no importance in the diet of the coots. Either the product of a trial-and-error method of feeding or else completely accidental in occurrence, each family had only one or two representatives in the food; was rarely found in more than two stomachs, often in only one; and contributed but a very small percentage (less than 0.1) or merely a trace of the total food. The presence of most of them illustrates the haphazard method of feeding often employed by coots.

The plant families furnishing the percentages under 0.1 numbered 6. The Fagaceae contributed the southern red oak (*Quercus rubra*), eaten by a single coot obtained in Missouri in January that had fed on it almost exclusively, having taken 2 whole acorns and fragments of 5 or 6 more. The Chenopodiaceae supplied the saltbush (*Atriplex*), stems and seeds of which were consumed by 5 coots collected in central California in January, forming no large percentage of the meal of any, although 1 had eaten 39 seeds. The birds were inhabiting rice fields and had ingested the saltbush in addition to rice. The Commelinaceae were represented by the dayflower (*Commelina*), many vegetative fragments of which formed half the contents of a stomach taken in Louisiana in January; the Urticaceae, by leaf fragments of the water-elm (*Planera aquatica*) in a stomach taken in Louisiana in October and by those of the American elm (*Ulmus americana*) in 1 taken in Missouri in April; coniferous plants (Pinaceae), by leaves and a few galls from the bald cypress (*Taxodium distichum*) in 2 stomachs from Menosha, Ark., and by a few needles of the Douglas fir (*Pseudotsuga taxifolia*) in 1 from Oregon; and the Rosaceae, by the fragment of a flower, unidentified beyond the family, in 1 stomach obtained in Missouri in April and by a small rose seed (*Rosa*) in 1 collected in Minnesota in September.

The plant families supplying mere traces of the total food were as follows: The Araceae, represented by a seed of arrow-arum (*Peltandra virginica*) in a stomach collected in Ohio in October and several seeds of the sweetflag (*Acorus calamus*) in a stomach from Alberta; the Myricaceae, by a seed fragment (*Myrica*) in a stomach obtained in Alabama and a seed of the bayberry (*M. carolinensis*) in one taken at Currituck Sound, N. C., in December; the Ranunculaceae, by a few seeds of the buttercup (*Ranunculus sceleratus*) in a stomach collected in North Dakota in May and in one from Iowa; the Rhamnaceae, by several seeds of the supplejack (*Berchemia scandens*) in a stomach taken in Missouri in April; the Umbelliferae, by one or two seeds of the water pennywort (*Hydrocotyle*) in each of three stomachs from Florida and in one from Louisiana, all obtained in fall and winter; the Ericaceae, by a single seed of the blueberry (*Vaccinium ovatum*) in a stomach from California; the Verbenaceae, by a seed of *Lippia lanceolata* in a stomach from the District of Columbia; the Solanaceae, by seeds of the bittersweet (*Solanum dulcamara*) in one stomach; the Scrophulariaceae, by unidentified seeds in one stomach; the Plantaginaceae, by seeds of *Plantago* sp., in one stomach and of plantain (*P. lanceolata*) in another; and the Compositae, by seeds of beggarticks (*Bidens cernua*) in one stomach and of ragweed (*Ambrosia artemisiifolia*) in another.

Plant debris (3.38 percent), or vegetation undetermined as to family, usually because it was so finely ground by digestive processes, was found in 65 stomachs.

ANIMAL FOOD—10.61 PERCENT

Although animal matter furnished only a tenth of the coots' food and was found in only about a third (234) of the stomachs, it was taken in all months of the year, much more commonly in spring and summer than in fall and winter, and in great variety, 57 families, including 73 genera and representing 26 orders, having been identified. Many of the items appeared but once, however. Nearly seven-tenths of the animal food consisted of insects (chiefly Coleoptera, Odonata, and Hemiptera) and almost three-tenths of mollusks (both univalves and bivalves). The slight remainder comprised arthropods, represented by very small percentages of crustaceans and arachnids and a mere trace of millepedes; vertebrates, consisting of fishes and amphibians in small numbers; and a few protozoans and bryozoans, each recorded as scarcely a trace.

A summary, by months, of the principal animal food groups, expressed by volumetric percentages, is given in table 3, following which the various groups are discussed in order of importance.

TABLE 3.—Summary, by months, of the main animal food groups, expressed by volumetric percentages, in the diet of 792 American coots

| Item | January | February | March | April | May | June | July-August ¹ | September | October | November | December | Total |
|------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|--------------------------|-----------------|-----------------|----------------|----------------|-----------------|
| Stomachs..... | Number 123 | Number 39 | Number 48 | Number 49 | Number 34 | Number 14 | Number 36 | Number 75 | Number 172 | Number 97 | Number 105 | Number 792 |
| Insecta (7.24 percent): | Percent 0.02 | Percent 0.10 | Percent 0.25 | Percent 1.29 | Percent 2.45 | Percent 11.22 | Percent 2.00 | Percent 0.04 | Percent 0.03 | Percent (2) | Percent (2) | Percent 1.60 |
| Coleoptera (2.23 percent): | (2) | (2) | (2) | .88 | 1.42 | 1.28 | 1.68 | .21 | .63 | 0.03 | (2) | .63 |
| Water beetles..... | | | | 1.34 | .41 | 3.36 | 13.67 | .37 | .28 | .04 | | 2.20 |
| Other beetles..... | | | .04 | 1.88 | 4.44 | 1.57 | 9.08 | .09 | .34 | .03 | (2) | 1.58 |
| Odonata (dragonflies, damselflies) | | | | | | | | | | | | |
| Hemiptera (true bugs) | | | | | | | | | | | | |
| Orthoptera (0.36 percent): | | | | | | .14 | 1.14 | .16 | .08 | | | .19 |
| Grasshoppers..... | | .49 | | | | | | | | | | .37 |
| Cricketids..... | | | | | 1.49 | | 2.30 | (2) | .26 | .01 | | .49 |
| Diptera (flies) | | .03 | .96 | | .32 | .64 | 3.41 | | .01 | | | .18 |
| Other insects..... | (2) | | (2) | .06 | .30 | 1.00 | .43 | | .13 | .03 | 0.16 | |
| Mollusca (2.95 percent): | | | | | | | | | | | | |
| Gastropoda (snails) | .03 | 2.20 | .77 | 3.31 | 1.65 | .36 | 5.16 | .31 | .43 | 2.63 | .89 | 1.61 |
| Pelecypoda (mussels) | .02 | .67 | .40 | 3.78 | 7.12 | (2) | .80 | 1.09 | .79 | .03 | | 1.34 |
| Arachnida (spiders) | (2) | | .06 | (2) | | | 2.25 | (2) | .01 | .04 | .11 | .22 |
| Crustacea..... | | (2) | .94 | | | (2) | (2) | .24 | .03 | | | .12 |
| Other animal food | (2) | | .04 | .02 | (2) | (2) | .22 | .01 | (2) | .62 | .01 | .08 |
| Total..... | .08 | 3.49 | 4.21 | 12.76 | 19.71 | 21.57 | 44.14 | 3.12 | 3.02 | 3.46 | 1.17 | 10.61 |

¹ July and August combined (footnote 2, p. 6).

Trace or less than 0.01 percent.

INSECTA—7.24 PERCENT

Coleoptera (2.23 percent).—The order Coleoptera includes the widest variety of items consumed by the coot. Beetles and weevils of 29 genera, representing 13 families, were identified, and 17 species were recognized. The predaceous diving beetles (Dytiscidae) in the food included *Laccophilus maculosus*, *Coptotomus* sp., *Dytiscus* sp., and undetermined forms, predominantly larvae, all usually taken in small quantities, although a young bird from British Columbia had been fed largely on dytiscid larvae. Water scavenger beetles (Hydrophilidae), represented by 5 genera, of which *Enochrus* and *Tropisternus* were most important, were found in 22 stomachs. Scarabaeidae were present in 25 stomachs. Three genera were identified, and dung beetles (*Aphodius distinctus*) and May beetles (*Phyllophaga*) furnished most of the percentage. Fragments of weevils (Curculionidae), noted in 2 stomachs from California and 3 from Iowa, included *Hypera punctata* and species of *Sphenophorus* and *Sitona*. Ground beetles (Carabidae), including *Poecilus lucublandus* and species of *Harpalus* and *Scarites*, were found in 14 stomachs. Leaf beetles (Chrysomelidae) contributed 5 genera, of which *Chalepus nervosa* and *Donacia* sp. were the only ones taken in sufficient quantity to furnish a percentage of the food. The Ostomidae were represented in 2 stomachs by *Tenebroides* sp.; and the Nitidulidae, in 1 by *Nitidula ziczac*. The remaining families noted in the food were recorded as traces only. They include crawling water beetles (Haliplidae), represented by *Peltodytes* sp. and *Haliplus fasciatus* in 1 stomach each; Anobiidae, by *Lasioderma serri-corne* in 2 stomachs; and undetermined rove beetles (Staphylinidae), Histeridae of the species *Hister harrisii*, and darkling water beetles (Tenebrionidae) of the genus *Tribolium* in 1 stomach each.

Odonata (2.2 percent).—Representatives of this order, mostly larvae and nymphs, formed the second largest percentage of the insect foods. Found in 68 stomachs and eaten in every month except December, with the peak of consumption in summer, they were particularly favored by birds in the Middle West, having formed a goodly percentage of the last meal of a number of individuals from Iowa. In 35 stomachs, the fragmentary remains prevented identification beyond the order; but in 15, dragonflies (Anisoptera) (pls. 4, *G*; 6, *B*) and in 18, damsel flies (Zygoptera) were recognized. Although the stomach occurrences of the 2 suborders were about equal, the dragonflies formed much the larger food percentage (1.08 as compared to 0.55).

Hemiptera (1.58 percent).—The true bugs were of some importance as insect food. In 8 of the stomachs in which found the remains could not be identified beyond the order; but in the others, 10 families and 9 genera were recognized. The water boatmen (Corixidae), by far the most important hemipteran family in the food, were found in 49 stomachs. In 45 of these the fragments permitted identification

only as far as the family. In 4 stomachs, however, 1 or more whole insects were identified as *Arctocorixa*, sp., whole bodies and many fragments of these insects aggregating 87 percent of the contents of 1 stomach (pl. 6, A). Broad-shouldered water striders (Veliidae) were represented by undetermined forms in 7 stomachs and by *Microvelia* sp., in 5, in 1 of which, that of a nestling from Utah, it formed the larger part of the contents. Giant water bugs (Belastomatidae) of the genus *Belastoma* were found in 3 stomachs; water striders (Gerridae) of the genus *Gerris*, in 4; and stinkbugs (Pentatomidae) of the species *Euschistus tristigmus*, in 1. The remaining 5 families, recorded only as traces, were represented as follows: Back swimmers (Notonectidae), by *Plea striola* in 3 stomachs and by *Notonecta* sp., in 1; leaf bugs (Miridae), by Capsinae and an undetermined form in 1 stomach each; nabids (Nabidae), by *Nabis ferus*, in 3 stomachs; and chinch bugs (Lygaeidae), by an undetermined form, and negro bugs (Cydnidae), by *Corimelaena* sp., in 1 stomach each.

Orthoptera (0.56 percent).—Insects of this group, found in 22 stomachs, were probably picked up while the coots were browsing about on land. It is doubtful if they are generally sought. About two-thirds of them were field crickets (Gryllidae), including *Gryllus assimilis* and *Nemobius* sp., found in 6 and 2 stomachs, respectively, and undetermined forms, in 3. Short-horned grasshoppers (Acrididae) mostly *Melanoplus* sp., were noted in 6 stomachs; and long-horned grasshoppers (Tettigoniidae), in 3. In investigations in Nebraska, Aughey (1878) reported finding 37 and 31 locusts in 2 stomachs from Dakota County, 49 in 1 from Dixon County, and 54 and 43 in 2 of 4 from Lancaster County.

Diptera (0.49 percent).—True flies, noted in only 18 stomachs, were evidently not a favorite food of the coots. Probably, like the grasshoppers, they are readily consumed when available but are not particularly sought. In 5 stomachs the determination was concluded with the order; but in the others, 6 families and 4 genera were identified. Most of the forms eaten were those having aquatic larvae, as three-fourths of the dipterous food consisted of the aquatic larvae and pupae of soldier flies (Stratiomyiidae) of 2 genera, *Nemotelus* and *Odontomyia*, found in 2 stomachs each, the puparia of the former comprising a large part of the food content of a stomach from Utah and a third of that of 1 from Colorado. Horseflies (Tabanidae), noted in 2 stomachs, and crane flies (Tipulidae), in 1, furnished very small percentages of the total food. Midges (Chironomidae), present in 4 stomachs, and gall gnats (Cecidomyiidae) and syrphus flies (Syrphidae), in 1 each, contributed only traces of the food.

Other insects (0.18 percent).—The remaining insects noted include several insect galls that are parasitic on the bald cypress (*Taxodium distichum*), caddisfly pupae (Limnephilidae and undetermined Trichop-

tera), Mayflies (Ephemeroptera), stone flies (Plecoptera), and some undetermined forms.

MOLLUSCA—2.95 PERCENT

Gastropods (1.61 percent).—Snails formed an important part of the animal food of the coots. They appeared in stomachs taken in all sections of the country and in every month, with no one season particularly favored. It is possible that some of the small forms were ingested incidentally along with masses of vegetation, but undoubtedly most of the snails were intentionally taken. Although 6 families, 12 genera, and 11 species were identified, in 20 stomachs the fragments were so minutely ground that they could be classified only as undetermined gastropods.

The Neritidae furnished more than three-tenths of the gastropod food and were represented by 2 genera, *Neritina* chiefly, found in 12 stomachs, and *Hydrobia*, found in 1. The *Neritina* species, which were fed upon most frequently in the Lower Mississippi and Gulf Region, comprised *N. reclusiana*, identified in 9 stomachs; *N. virginea*, in 2; and an undetermined species, in 1. Pond snails (Lymnaeidae) of 2 genera were eaten; namely, species of *Lymnaea*, which furnished the highest gastropod food percentage, noted in 6 stomachs, and those of *Stagnicola*, noted in 4. The Amnicolidae contributed species of the genus *Amnicola*, 1 of the 2 principal genera from the East coast, which were found in 8 stomachs, and *Fluminicola virens*, recorded in 5 stomachs from the Pacific coast of Oregon. The orb snails (Planorbidae) furnished 4 genera, 1 of which, *Helisoma*, supplied the entire percentage for the family, undetermined species of it having been found in 4 stomachs and *H. trivolvis* in 1. The other orb snails noted, which furnished only traces of the food, included *Planorbula armigera*, found in 2 stomachs; and *Gyraulus parvus* and *Parapholix effusa*, each found in 1. Stream snails (Pleuroceratidae) of the genus *Goniobasis*, the other of the 2 principal East coast genera, were present in 4 stomachs, *G. virginica* in 3, and *G. livescens* and an undetermined species each in 1. Mud snails (Nassidae) were represented in a single stomach by *Nassa obsoleta*.

Pelecypods (1.34 percent).—Mussels also constituted quite an important animal food, the selections, however, being much less varied than in the case of the snails. They were consumed in every month, but the largest quantities were taken in spring, when small young mussels are available. The percentages are based upon occurrences in 55 stomachs, chiefly from the Middle West. The powerful stomach muscles of the coot are quite capable of crushing small mussel shells into minute particles, and in 42 stomachs the fragmentary remains could be designated only as undetermined Pelecypoda. Fresh-water mussels (Unionidae) were noted in 12 stomachs, and many small fin-

gernail clams (Cyrenidae), identified as *Sphaerium fabale*, formed more than a third of the contents of a stomach from Minnesota. Lewis (1879) reported from Bridgeport finding 722 clams [species not mentioned] in the stomach of a coot that he had shot at Black Rock Harbor.

ARACHNIDA—0.22 PERCENT

Spiders (Araneida), found in 14 stomachs, formed the entire percentage of the arachnid food, but a mite (Acarina), a water mite (Hydrachnidae), and an unidentified form, each occurring but once, were recorded as traces.

CRUSTACEA—0.12 PERCENT

It is quite evident that crustaceans, the remains of which were found in but 12 stomachs, do not form an important article of diet but may be ingested incidentally or accidentally along with other foods. The entire percentage was furnished by amphipods and decapods, but phyllopods, isopods, and an undetermined crustacean contributed traces. The amphipods comprised an undetermined form, unidentified Gammaridae, and *Hyaletta azteca*, a species of the Orchestiidae, each noted once; the decapods, of fragments of crawfishes (*Cambarus*), found in 2 stomachs; the phyllopods, of ehippia (cases containing the winter eggs) of the water flea (*Daphnia*), found in 4 stomachs; and the isopods, of an unidentified form and *Asellus communis*, each occurring once.

VERTEBRATA—0.02 PERCENT

Vertebrate animals rarely entered into the diet of the coots examined. The very small percentage they supplied of the total food was derived entirely from amphibians, which were noted in only two stomachs, bone fragments of a tiger salamander (*Ambystoma tigrinum*) in one from South Dakota, forming a tenth of the contents, and a few undetermined bones in one from Iowa. Fishes played only a small and unimportant part in the diet, as they contributed a mere trace of the total and were found in but three stomachs, minnows (*Cyprinidae*) in two and the resistant otolith of an undertermined fish in one. As for birds, no stomach contained even a trace of young birds or bird eggs of either their own or other species. Taylor (1894) tells of a coot tearing off the feathers from a freshly killed duck and eating away a considerable part of the breast, but as Taylor had just shot the duck the coot's action was probably the result of curiosity. From the present stomach examinations, it seems doubtful that coots in general do much, if any, damage, so far as predation is concerned, either to fish hatcheries or to nesting birds or their nests.

In literature, however, there are conflicting reports as to whether coots eat fish as a part of their regular diet. A correspondent (Anonymous 1876), in writing to ask the editor of *Forest and Stream* what to feed a captured coot, stated of the bird: "He refuses live fish, clams, and corn," and Byrne (1882) says:

I have opened and examined a large number of their gizzards and have never found any animal material in them at all, except an empty snail shell in one. * * * and feel confident that those who have, as they supposed, seen the coot eating fish, were mistaken, and mistook it for the "pied-billed grebe," a somewhat similar looking, smaller bird, generally numerous in the same waters with the coot.

On the other hand, Polk (1882) in challenging Byrne's statement says he has "often seen them emerge from a dive with wriggling minnows in their bills, which they gulped down in short order and with apparent gusto."

OTHER ANIMAL FOOD—0.06 PERCENT

The entire percentage was contributed by a small quantity of unidentified animal matter, but the category includes other forms that furnished traces of the food, as follows: Protozoans (Mastigophora and undetermined forms), noted in two stomachs; bryozoans, in the form of statoblasts of moss animalcules, in five, namely, *Plumatella* and *Cristatella*, each in two, and an unidentified form, in one; and a diplopod (*Parajulus*), in one.

SYSTEMATIC LIST OF FOODS

Table 4 lists in systematic order every food found in the 792 coot stomachs and gives the volumetric percentage it formed of the total food and the number of stomachs in which it was noted. It should be borne in mind that for individual stomachs the total number of food items varied greatly, ranging from 1 to 23, but averaged slightly more than 4.

TABLE 4.—*Systematic list of foods in 792 American coot stomachs, showing volumetric percentages and number of stomachs in which found*

PLANT FOOD—89.39 PERCENT

| Food item | Volumetric percentage | Number of stomachs in which found |
|---|-----------------------|-----------------------------------|
| THALLOPHYTA (13.7 PERCENT) | | |
| Algae: | | |
| Filamentous algae | 3.71 | 93 |
| Characeae (muskgrasses): | | |
| <i>Chara</i> sp. | 8.48 | 193 |
| <i>Nitella</i> sp. | 1.34 | 77 |
| Undetermined | .17 | 15 |
| PTERIDOPHYTA (0.18 PERCENT) | | |
| <i>Polystichum achrostichoides</i> (Christmas fern) | .04 | 1 |
| <i>Marsilea vestita</i> (pepperwort) | .01 | 1 |
| <i>Equisetum</i> sp. (horsetail) | .13 | 2 |

TABLE 4.—Systematic list of foods in 792 American coot stomachs, showing volumetric percentages and number of stomachs in which found—Continued

| PLANT FOOD—89.39 PERCENT—Continued | | |
|---|-----------------------|-----------------------------------|
| Food item | Volumetric percentage | Number of stomachs in which found |
| SPERMATOPHYTES (72.13 PERCENT) | | |
| Pinaceae (0.01 percent): | | |
| <i>Pseudotsuga taxifolia</i> (Douglas fir)..... | (1) | 1 |
| <i>Taxodium distichum</i> (bald cypress)..... | 0.01 | 2 |
| Typhaceae (0.25 percent): | | |
| <i>Typha</i> sp. (cattail)..... | .25 | 2 |
| Sparganiaceae (0.49 percent): | | |
| <i>Sparganium eurycarpum</i> (burreed)..... | .12 | 17 |
| sp. undetermined..... | .37 | 33 |
| Najadaceae (40.64 percent): | | |
| <i>Potamogeton americanus</i> (pondweed)..... | 1.64 | 37 |
| <i>foliosus</i> | 1.26 | 15 |
| <i>heterophyllus</i> | .04 | 5 |
| <i>lucens</i> | .03 | 1 |
| <i>natans</i> | .01 | 3 |
| <i>pectinatus</i> | 5.30 | 249 |
| <i>perfoliatus</i> | .03 | 35 |
| <i>pusillus</i> | .23 | 35 |
| <i>zosteriformis</i> | .09 | 1 |
| sp. undetermined..... | 4.05 | 169 |
| <i>Ruppia maritima</i> (wigeongrass)..... | 8.11 | 240 |
| <i>Zannichellia palustris</i> (horned pondweed)..... | .11 | 1 |
| <i>Zostera marina</i> (eelgrass)..... | .54 | 25 |
| <i>Najas flexilis</i> (northern naiad)..... | 14.23 | 294 |
| <i>guadalupensis</i> (southern naiad)..... | 3.71 | 73 |
| sp. undetermined..... | 1.26 | 47 |
| Juncaginaceae (0.7 percent): | | |
| <i>Triglochin maritima</i> (arrowgrass)..... | .70 | 3 |
| Alismaceae (0.35 percent): | | |
| <i>Sagittaria heterophylla</i> (arrowhead)..... | (1) | 2 |
| <i>latifolia</i> | (1) | 1 |
| sp. undetermined..... | .35 | 5 |
| <i>Alisma</i> sp. (waterplantain)..... | (1) | 2 |
| Hydrocharitaceae (1.43 percent): | | |
| <i>Anacharis canadensis</i> (waterweed)..... | .71 | 22 |
| <i>Vallisneria spiralis</i> (wildcelery)..... | .72 | 69 |
| Gramineae (9.22 percent): | | |
| <i>Andropogon virginicus</i> (broomsedge)..... | (1) | 1 |
| sp. undetermined..... | (1) | 1 |
| <i>Digitaria</i> sp. (crabgrass)..... | .20 | 3 |
| <i>Paspalum</i> sp. (paspalum)..... | (1) | 1 |
| <i>Panicum</i> sp. (panic grass)..... | .02 | 2 |
| <i>Echinochloa crusgalli</i> (millet)..... | .23 | 13 |
| <i>Setaria viridis</i> (pigeongrass)..... | (1) | 2 |
| <i>Zizania aquatica</i> (wildrice)..... | 2.98 | 41 |
| <i>Zizaniopsis miliacea</i> (giant cutgrass)..... | (1) | 2 |
| <i>Leersia oryzoides</i> (rice cutgrass)..... | (1) | 1 |
| <i>virginica</i> (whitegrass)..... | (1) | 2 |
| <i>Oryza sativa</i> (rice)..... | 1.52 | 21 |
| <i>Avena sativa</i> (oats)..... | 1.99 | 34 |
| sp. undetermined..... | (1) | 1 |
| <i>Secale cereale</i> (rye)..... | .03 | 1 |
| <i>Eragrostis</i> sp. (lovegrass)..... | (1) | 1 |
| <i>Distichlis stricta</i> (saltgrass)..... | (1) | 1 |
| sp. undetermined..... | .16 | 4 |
| <i>Poa</i> sp. (bluegrass)..... | .30 | 2 |
| <i>Triticum aestivum</i> (wheat)..... | (1) | 2 |
| Undetermined..... | .79 | 26 |
| Cyperaceae (13.73 percent): | | |
| <i>Cyperus diandrus</i> (cyperus)..... | (1) | 1 |
| <i>erythrorhizos</i> | .05 | 1 |
| <i>ferax</i> | .47 | 2 |
| <i>flavescens</i> | .01 | 1 |
| sp. undetermined..... | .68 | 13 |
| <i>Kyllinga pumila</i> (kyllinga)..... | (1) | 1 |
| <i>Dulichium arundinaceum</i> | .01 | 1 |
| <i>Eleocharis acicularis</i> (slender spikerush)..... | .62 | 3 |
| <i>olivacea</i> (spikerush)..... | (1) | 1 |
| <i>palustris</i> (common spikerush)..... | .13 | 4 |
| <i>prolifera</i> (spikerush)..... | .41 | 3 |
| <i>quadrangulata</i> (squarestem spikerush)..... | .07 | 1 |
| sp. undetermined..... | 1.95 | 50 |
| <i>Scirpus acutus</i> (hardstem bulrush)..... | 4.09 | 162 |
| <i>americanus</i> (common threesquare)..... | .42 | 27 |
| <i>californicus</i> (southern bulrush)..... | .19 | 7 |

¹ Trace, or less than 0.01 percent.

TABLE 4.—Systematic list of foods in 792 American coot stomachs, showing volumetric percentages and number of stomachs in which found—Continued

PLANT FOOD—89.39 PERCENT—Continued

| Food item | Volumetric percentage | Number of stomachs in which found |
|--|-----------------------|-----------------------------------|
| SPERMATOPHYTA (72.13 PERCENT)—continued | | |
| Cyperaceae (13.73 percent)—Continued. | | |
| <i>Scirpus acutus</i> (hardstem bulrush)—Continued. | | |
| <i>etuberculatus</i> (swamp bulrush)..... | (1) | 1 |
| <i>fluvialis</i> (river bulrush)..... | 0.29 | 19 |
| <i>heterochaetus</i> (slender bulrush)..... | (1) | 9 |
| <i>paludosus</i> (alkali bulrush)..... | .03 | 5 |
| <i>validus</i> (softstem bulrush)..... | .10 | 9 |
| sp. undetermined..... | 3.33 | 56 |
| <i>Mariscus jamaicensis</i> (sawgrass)..... | .06 | 9 |
| <i>mariscoides</i> | (1) | 2 |
| sp. undetermined..... | .01 | 5 |
| <i>Carex filiformis</i> (sedge)..... | (1) | 5 |
| <i>lacustris</i> | .34 | 13 |
| <i>lupuliformis</i> | (1) | 1 |
| <i>lupulina</i> | (1) | 1 |
| <i>tribuloides</i> | (1) | 1 |
| sp. undetermined..... | .47 | 46 |
| Undetermined..... | (1) | 1 |
| Araceae: ¹ | | |
| <i>Peltandra virginica</i> (arrow-arum)..... | (1) | 1 |
| <i>Acorus calamus</i> (sweetflag)..... | (1) | 1 |
| Lemnaceae (1.55 percent): | | |
| <i>Spirodela polyrhiza</i> (big duckweed)..... | .21 | 8 |
| <i>Lemna minima</i> (duckweed)..... | (1) | 3 |
| <i>minor</i> | .46 | 27 |
| <i>trisulca</i> | .22 | 15 |
| sp. undetermined..... | .66 | 12 |
| Commelinaceae (0.04 percent): | | |
| <i>Commelina</i> sp. (dayflower)..... | .04 | 1 |
| Pontederiaceae (0.86 percent): | | |
| <i>Pontederia cordata</i> (pickerelweed)..... | (1) | 1 |
| sp. undetermined..... | .65 | 1 |
| <i>Heteranthera dubia</i> (waterstargrass)..... | .21 | 8 |
| Myricaceae: ¹ | | |
| <i>Myrica carolinensis</i> (bayberry)..... | (1) | 1 |
| sp. undetermined..... | (1) | 1 |
| Fagaceae (0.07 percent): | | |
| <i>Quercus rubra</i> (southern red oak)..... | .07 | 1 |
| Urticaceae (0.03 percent): | | |
| <i>Ulmus americana</i> (American elm)..... | .01 | 1 |
| <i>Planera aquatica</i> (water-elm)..... | .02 | 1 |
| Polygonaceae (0.13 percent): | | |
| <i>Rumex maritimus</i> var. <i>fuiginus</i> (golden dock)..... | (1) | 4 |
| sp. undetermined..... | (1) | 3 |
| <i>Polygonum amphibium</i> (water smartweed)..... | .05 | 9 |
| <i>lapathifolium</i> (noddling smartweed)..... | .02 | 26 |
| <i>muhlenbergii</i> (marsh smartweed)..... | (1) | 4 |
| <i>opelousanum</i> | (1) | 2 |
| <i>pensylvanicum</i> (largeseed smartweed)..... | .06 | 3 |
| <i>persicaria</i> (ladythumb)..... | (1) | 3 |
| <i>punctatum</i> (dotted smartweed)..... | (1) | 3 |
| <i>virginianum</i> | (1) | 1 |
| sp. undetermined..... | (1) | 4 |
| Chenopodiaceae (0.07 percent): | | |
| <i>Atriplex</i> sp. (saltbush)..... | .07 | 5 |
| Ceratophyllaceae (2.1 percent): | | |
| <i>Ceratophyllum demersum</i> (coontail)..... | 2.10 | 56 |
| Nymphaeaceae (0.38 percent): | | |
| <i>Nuphar advena</i> (spatterdock)..... | .01 | 2 |
| sp. undetermined..... | .02 | 1 |
| <i>Nymphaea odorata</i> (waterlily)..... | .07 | 4 |
| <i>Brasenia schreberi</i> (watershield)..... | .28 | 12 |
| <i>Cabomba caroliniana</i> (fanwort)..... | (1) | 1 |
| Ranunculaceae: ¹ | | |
| <i>Ranunculus sceleratus</i> (buttercup)..... | (1) | 2 |
| Rosaceae (0.01 percent): | | |
| <i>Rosa</i> sp. (rose)..... | (1) | 1 |
| Undetermined..... | .01 | 1 |
| Leguminosae (0.28 percent): | | |
| <i>Trifolium repens</i> (white clover)..... | .05 | 1 |
| sp. undetermined..... | .23 | 2 |
| Rhamnaceae: ¹ | | |
| <i>Berchemia scandens</i> (supplejack)..... | (1) | 1 |

¹ Trace, or less than 0.01 percent.

TABLE 4.—Systematic list of foods in 792 American coot stomachs, showing volumetric percentages and number of stomachs in which found—Continued

PLANT FOOD—89.39 PERCENT—Continued

| Food item | Volumetric percentage | Number of stomachs in which found |
|--|-----------------------|-----------------------------------|
| SPERMATOPHYTA (72.13 PERCENT)—continued | | |
| Haloragidaceae (0.23 percent): | | |
| <i>Myriophyllum spicatum</i> (watermilfoil)..... | 0.15 | 5 |
| sp. undetermined..... | .05 | 4 |
| <i>Proserpinaca palustris</i> (mermaidweed)..... | .03 | 1 |
| sp. undetermined..... | (1) | 1 |
| <i>Hippuris vulgaris</i> (marestail)..... | (1) | 2 |
| Umbelliferae: ¹ | | |
| <i>Hydrocotyle</i> sp. (water pennywort)..... | (1) | 4 |
| Ericaceae: ¹ | | |
| <i>Vaccinium ovatum</i> (blueberry)..... | (1) | 1 |
| Convolvulaceae (0.14 percent): | | |
| <i>Convolvulus</i> sp. (bindweed)..... | (1) | 1 |
| <i>Cuscuta</i> sp. (dodder)..... | .14 | 5 |
| Verbenaceae: | | |
| <i>Lippia lanceolata</i> (lippia)..... | (1) | 1 |
| Solanaceae: ¹ | | |
| <i>Solanum dulcamera</i> (bittersweet)..... | (1) | 1 |
| Scrophulariaceae..... | (1) | 1 |
| Plantaginaceae: ¹ | | |
| <i>Plantago lanceolata</i> (plantain)..... | (1) | 1 |
| sp. undetermined..... | (1) | 1 |
| Rubiaceae (0.42 percent): | | |
| <i>Cephalanthus occidentalis</i> (buttonbush)..... | .42 | 8 |
| Compositae: ¹ | | |
| <i>Bidens cernua</i> (beggarticks)..... | (1) | 1 |
| <i>Ambrosia artemisiifolia</i> (ragweed)..... | (1) | 1 |
| UNDETERMINED (3.38 PERCENT) | | |
| Miscellaneous plant material..... | 3.38 | 65 |

ANIMAL FOOD—10.61 PERCENT

| | | |
|---|------|----|
| PROTOZOA ¹ | | |
| Mastigophora..... | (1) | 1 |
| Undetermined..... | (1) | 1 |
| BRYOZOA ¹ | | |
| Plumatellidae: | | |
| <i>Plumatella</i> sp..... | (1) | 2 |
| Cristatellidae: | | |
| <i>Cristatella mucedo</i> | (1) | 1 |
| sp. undetermined..... | (1) | 1 |
| Undetermined Bryozoa..... | (1) | 1 |
| CRUSTACEA (0.12 PERCENT) | | |
| Phyllopoda: | | |
| Daphnidae: <i>Daphnia</i> sp. (water fleas)..... | (1) | 4 |
| Amphipoda: | | |
| Orchestiidae: <i>Hyaella azteca</i> (beach flea)..... | 0.01 | 1 |
| Gammaridae..... | .09 | 1 |
| Undetermined..... | (1) | 1 |
| Isopoda: | | |
| Asellidae: <i>Asellus communis</i> | (1) | 1 |
| Undetermined..... | (1) | 1 |
| Decapoda: | | |
| Astacidae: <i>Cambarus</i> sp. (crawfishes)..... | .02 | 2 |
| Undetermined Crustacea..... | (1) | 1 |
| ARACHNIDA (0.22 PERCENT) | | |
| Araneida (spiders)..... | .22 | 14 |
| Acarina (mites): | | |
| Hydrachnidae..... | (1) | 1 |
| Undetermined..... | (1) | 1 |
| Undetermined Arachnida..... | (1) | 1 |
| DIPLOPODA ¹ | | |
| Julidae: <i>Parajulus</i> sp..... | (1) | 1 |

¹ Trace, or less than 0.01 percent.

TABLE 4.—*Systematic list of foods in 792 American coot stomachs, showing volumetric percentages and number of stomachs in which found—Continued*

ANIMAL FOOD—10.61 PERCENT—Continued

| Food item | Volumetric percentage | Number of stomachs in which found |
|---|-----------------------|-----------------------------------|
| INSECTA (7.24 PERCENT) | | |
| Orthoptera (0.56 percent): | | |
| Acrididae (short-horned grasshoppers): | | |
| Cyrtacanthacrinæ: | | |
| <i>Melanoplus</i> sp. | 0.05 | 1 |
| Undetermined | .02 | 1 |
| Undetermined | .06 | 4 |
| Tettigoniidae (long-horned grasshoppers) .. | .02 | 3 |
| Gryllidae (crickets): | | |
| <i>Gryllus assimilis</i> | .29 | 6 |
| <i>Nemobius</i> sp. | .01 | 2 |
| Undetermined | .07 | 3 |
| Undetermined | .04 | 2 |
| Undetermined | .09 | 3 |
| Ephemeroptera (Mayflies) | | |
| Odonata (2.2 percent): | | |
| Anisoptera (dragonflies) | 1.08 | 15 |
| Zygoptera (damselflies): | | |
| Coenagrionidae: | | |
| <i>Ischnura</i> sp. | .06 | 3 |
| Undetermined | (¹) | 1 |
| Undetermined | .49 | 14 |
| Undetermined | .57 | 35 |
| Plecoptera (stone flies) | (¹) | 1 |
| Hemiptera (1.58 percent): | | |
| Corixidae (water boatmen): | | |
| <i>Arctocorixa</i> sp. | .43 | 4 |
| Undetermined | .59 | 45 |
| Notonectidae (back swimmers): | | |
| <i>Notonecta</i> sp. | (¹) | 1 |
| <i>Plea striola</i> | (¹) | 3 |
| Belastomatidae (giant water bugs): | | |
| <i>Belastoma</i> sp. | .13 | 3 |
| Veliidae (broad-shouldered water striders): | | |
| <i>Microvelia</i> sp. | (¹) | 5 |
| Undetermined | .40 | 7 |
| Gerridae (water striders): | | |
| <i>Gerris</i> sp. | .02 | 4 |
| Miridae (leaf bugs): | | |
| Capsinæ | (¹) | 1 |
| Undetermined | (¹) | 1 |
| Nabidae: | | |
| <i>Nabis ferus</i> | (¹) | 3 |
| Lygaeidae (chinch bugs) | (¹) | 1 |
| Pentatomidae (stinkbugs): | | |
| <i>Euschistus tristigmus</i> | .01 | 1 |
| Cydnidae (negro bugs): | | |
| <i>Corimelaena</i> sp. | (¹) | 1 |
| Undetermined | (¹) | 8 |
| Homoptera (0.01 percent): | | |
| Membracidae (treehoppers) | (¹) | 1 |
| Cicadellidae (leafhoppers) | .01 | 4 |
| Coleoptera (2.23 percent): | | |
| Carabidae (ground beetles): | | |
| <i>Scarites</i> sp. | (¹) | 1 |
| <i>Poecilus lucublandus</i> | .01 | 1 |
| <i>Harpalus pennsylvanicus</i> | .02 | 1 |
| sp. undetermined | (¹) | 1 |
| Undetermined | .05 | 10 |
| Halipidae (crawling water beetles): | | |
| <i>Peltodytes</i> sp. | (¹) | 1 |
| <i>Halipus fasciatus</i> | (¹) | 1 |
| Dytiscidae (predaceous diving beetles): | | |
| <i>Laccophilus maculosus</i> | .01 | 1 |
| <i>Coptotomus</i> sp. | (¹) | 1 |
| <i>Dytiscus</i> sp. | .33 | 14 |
| Undetermined | .64 | 17 |
| Hydrophilidae (water scavenger beetles): | | |
| <i>Ochthebius holmbergi</i> | (¹) | 1 |
| <i>Hydrochus</i> sp. | (¹) | 1 |
| <i>Hydrophilus triangularis</i> | (¹) | 1 |
| <i>Tropisternus glaber</i> | .04 | 2 |
| <i>nimbatus</i> | .01 | 1 |
| sp. undetermined | .03 | 4 |

¹ Trace, or less than 0.01 percent.

TABLE 4.—Systematic list of foods in 792 American coot stomachs, showing volumetric percentages and number of stomachs in which found—Continued

ANIMAL FOOD—10.61 PERCENT—Continued

| Food item | Volumetric percentage | Number of stomachs in which found |
|--|-----------------------|-----------------------------------|
| INSECTA (7.24 PERCENT)—Continued | | |
| Coleoptera (2.23 percent)—Continued. | | |
| Hydrophilidae (water scavenger beetles)—Continued. | | |
| <i>Enochrus diffusus</i> | 0.16 | 3 |
| sp. undetermined..... | .18 | 4 |
| Undetermined..... | .20 | 5 |
| Staphylinidae (rove beetles)..... | (1) | 1 |
| Histeridae: | | |
| <i>Hister harrisii</i> | (1) | 1 |
| Ostomidae: | | |
| <i>Tenebroides</i> sp..... | .01 | 2 |
| Nitidulidae: | | |
| <i>Nitidula ziczac</i> | .01 | 1 |
| Tenebrionidae (darkling beetles): | | |
| <i>Tribolium</i> sp..... | (1) | 1 |
| Anobiidae: | | |
| <i>Lasioderma serricorne</i> | (1) | 2 |
| Scarabaeidae (scarab beetles): | | |
| <i>Onthophagus</i> sp..... | (1) | 1 |
| <i>Aphodius distinctus</i> | .07 | 14 |
| sp. undetermined..... | (1) | 1 |
| <i>Phyllophaga crenulata</i> | .10 | 1 |
| sp. undetermined..... | .05 | 6 |
| Undetermined..... | .01 | 2 |
| Chrysomelidae (leaf beetles): | | |
| <i>Donacia</i> sp..... | .01 | 4 |
| <i>Haemonia nigricornis</i> | (1) | 1 |
| <i>Graphops</i> sp..... | (1) | 1 |
| <i>Leptinotarsa decemlineata</i> | (1) | 1 |
| <i>Chalepus nervosa</i> | .02 | 1 |
| Undetermined..... | (1) | 1 |
| Curculionidae (weevils): | | |
| <i>Sphenophorus</i> sp..... | .03 | 4 |
| <i>Hypera punctata</i> | .08 | 2 |
| <i>Sitona</i> sp..... | (1) | 1 |
| Undetermined..... | .12 | 4 |
| Undetermined..... | .04 | 16 |
| Trichoptera (0.02 percent): | | |
| Limnephilidae (caddisflies)..... | .01 | 1 |
| Undetermined..... | .01 | 1 |
| Lepidoptera (butterflies and moths)..... | .02 | 7 |
| Diptera (0.49 percent): | | |
| Tipulidae (crane flies)..... | .01 | 1 |
| Chironomidae (midges): | | |
| <i>Chironomus</i> sp..... | (1) | 1 |
| Undetermined..... | (1) | 3 |
| Cecidomyiidae (gall gnats)..... | (1) | 1 |
| Stratiomyidae (soldier flies): | | |
| <i>Odontomyia</i> sp..... | .09 | 2 |
| <i>Nemotelus</i> sp..... | .28 | 2 |
| Tabanidae (horseflies): | | |
| <i>Tabanus</i> sp..... | (1) | 1 |
| Undetermined..... | .02 | 1 |
| Syrphidae (syrphus flies)..... | (1) | 1 |
| Undetermined..... | .09 | 5 |
| Hymenoptera (0.04 percent): | | |
| Ichneumonidae (parasitic wasps)..... | (1) | 1 |
| Formicidae (ants): | | |
| <i>Myrmica</i> sp..... | (1) | 2 |
| <i>Camponotus</i> sp..... | .01 | 3 |
| <i>Lasius niger</i> | (1) | 1 |
| sp. undetermined..... | .02 | 6 |
| Undetermined..... | (1) | 3 |
| Apidae (honeybees): | | |
| <i>Apis mellifica</i> | (1) | 1 |
| Undetermined..... | .01 | 4 |
| Insect galls: ¹ | | |
| <i>Itonida anthici</i> | (1) | 1 |
| <i>taxodii</i> | (1) | 1 |
| <i>Retinodiplosis taxodii</i> | (1) | 1 |
| Undetermined..... | (1) | 1 |
| Undetermined Insecta..... | (1) | 5 |

¹ Trace, or less than 0.01 percent.

TABLE 4.—Systematic list of foods in 792 American coot stomachs, showing volumetric percentages and number of stomachs in which found—Continued

ANIMAL FOOD—10.61 PERCENT—Continued

| Food item | Volumetric percentage | Number of stomachs in which found |
|---|-----------------------|-----------------------------------|
| MOLLUSCA (2.95 PERCENT) | | |
| Gastropoda (1.61 percent): | | |
| Nassidae (mud snails): | | |
| <i>Nassa obsoleta</i> | 0.01 | 1 |
| Amnicolidae: | | |
| <i>Amnicola limosa</i> | .03 | 6 |
| sp. undetermined..... | .09 | 2 |
| <i>Fuminicola rirens</i> | .24 | 5 |
| Pleuroceratidae (stream snails): | | |
| <i>Goniobasis livescens</i> | (¹) | 1 |
| <i>virginica</i> | .04 | 3 |
| sp. undetermined..... | (¹) | 1 |
| Neritidae: | | |
| <i>Neritina reclinata</i> | .28 | 9 |
| <i>virginica</i> | .01 | 2 |
| sp. undetermined..... | .19 | 1 |
| <i>Hydrobia</i> sp..... | .03 | 1 |
| Lymnaeidae (pond snails): | | |
| <i>Lymnaea</i> sp..... | .33 | 6 |
| <i>Stagnicola</i> sp..... | .08 | 4 |
| Planorbidae (orb snails): | | |
| <i>Helisoma trivolvis</i> | (¹) | 1 |
| sp. undetermined..... | .08 | 4 |
| <i>Gyraulus parvus</i> | (¹) | 1 |
| <i>Parapholyz effusa</i> | (¹) | 1 |
| <i>Planorbula armigera</i> | (¹) | 2 |
| Undetermined..... | .20 | 20 |
| Pelecypoda (1.34 percent): | | |
| Unionidae (fresh-water mussels)..... | .37 | 12 |
| Cyrenidae (fingernail clams): | | |
| <i>Sphaerium fabale</i> | .02 | 1 |
| Undetermined..... | .95 | 42 |
| PISCES ¹ | | |
| Cyprinidae (minnows)..... | (¹) | 2 |
| Undetermined Pisces..... | (¹) | 1 |
| AMPHIBIA (0.02 PERCENT) | | |
| <i>Ambystoma tigrinum</i> (tiger salamander)..... | .02 | 1 |
| Undetermined Amphibia..... | (¹) | 1 |
| UNDETERMINED (0.06 PERCENT) | | |
| Miscellaneous animal material..... | .06 | 1 |

¹ Trace, or less than 0.01 percent.

FOOD OF JUVENILES

The stomachs of the 15 juvenile coots examined were taken during May, June, and July. Of these Iowa supplied 5, Utah 4, British Columbia 3, and North Dakota, Nebraska, and Colorado, 1 each. Although the juveniles ate much the same sort of food as the adults, in which plant material predominated and the consumption of animal food was at its peak in June and July, the proportion of animal food was much greater for the juveniles (nearly half the total food) than for the adults (about a tenth of the total food). A systematic list of all foods noted in the juvenile stomachs is recorded in table 5, p. 42. The main groups of food taken, arranged in order of importance, are listed below. Gravel, including sand, which formed 17.13 percent of the gross stomach contents, was found in 12 stomachs, in 4 of them as only a trace.

Main food groups, arranged in order of volumetric percentages, in the diet of 15 juvenile American coots

| | |
|-----------------------------|-------|
| Plant food..... | 53.40 |
| Algae..... | 19.60 |
| Cyperaceae (sedges)..... | 18.06 |
| Najadaceae (pondweeds)..... | 13.68 |
| Other plant food..... | 2.06 |
| Animal food..... | 46.60 |
| Insects..... | 44.46 |
| Mollusks..... | 1.80 |
| Spiders..... | .34 |

PLANT FOOD—53.4 PERCENT

Vegetation, which formed a little more than half the entire food of the juveniles, was consumed by 14 of the 15 young birds, exclusively by 1 and almost so by 2, but in very small quantities by 3. In all, 8 families were identified; and in most instances the genus was recognized, often the species.

Algae (19.6 percent).—Algae, which were noted in six stomachs, in one exclusively, supplied the highest percentage of the plant food. The forms taken were muskgrass (*Chara*) and filamentous algae, found in three stomachs each.

Cyperaceae (18.06 percent).—Plants of the sedge family contributed the next highest plant food percentage. Bulrushes (*Scirpus*) were most relished, as their remains formed a little more than seven-tenths of all the sedge food and were noted in more than half the stomachs, sometimes 2 or more species in 1. Seeds and vegetation of *Scirpus* sp. were found in 3 stomachs; of the hardstem bulrush (*S. acutus*), in 8; and of the alkali bulrush (*S. paludosus*), in 2. Seeds of the spikerush (*Eleocharis palustris*) and of the sedges *Carex* sp. and *C. lacustris* were noted in 1 stomach each—338 *Carex* seeds in 1 of them, from Iowa.

Najadaceae (13.68 percent).—Although not as popular with the young coots as with the adults (40.64 percent), pondweeds comprised a substantial proportion of the juvenile plant food. They consisted entirely of species of *Potamogeton*. The leafy vegetation of undetermined species of the genus, noted in 4 stomachs, supplied most of the percentage and the seeds of *P. foliosus* and sago pondweed (*P. pectinatus*), the rest. Traces only were contributed by the longleaf pondweed (*P. americanus*) and *P. pusillus*, each noted but once.

Other plant food (2.06 percent).—Of the remaining plant families identified the following three furnished very small percentages of the total food, the various items comprising them having been found in only one stomach each: The Lemnaceae, represented by leaves of duckweed (*Lemna*); the Sparganiaceae, by seeds of the giant burreed (*Sparganium eurycarpum*); and the Polygonaceae, by three species of smartweeds (*Polygonum amphibium*, *P. lapathifolium*, and *P. persi-*

caria) and one of dock (*Rumex*). Two families each occurred in a single stomach so sparingly that they furnished only a trace of the total food, namely, the Gramineae, represented by saltgrass (*Distichlis stricta*), and the Compositae, by ragweed (*Ambrosia artemisiifolia*). Undetermined plant debris was noted in one stomach.

ANIMAL FOOD—46.6 PERCENT

Animal food, of which insects supplied more than nine-tenths of the bulk and spiders and mollusks the rest, was but slightly less popular than plant food with the juvenile coots. It also was taken by 14 of the 15 examined, by 2 exclusively and by 2 in such small quantities that it formed mere traces of their food. Most of the birds had eaten a variety of items. The animal food found embraces 13 orders, beyond which, in many instances, the finely divided fragments prevented identification.

Insects (44.46 percent).—More than a third of the insects eaten by the juveniles consisted of Coleoptera of 4 families and 4 genera, which were found in 13 stomachs, sometimes several in 1. They were the most important order not only in the insect food but in the animal food as well. Best liked were the aquatic varieties, as more than three-fourths of the coleopterous food was supplied by predaceous diving beetles (Dytiscidae), represented by *Dytiscus* sp. in 2 stomachs and undetermined forms in 1, and by water scavenger beetles (Hydrophilidae), represented by *Enochrus* sp. in 1 stomach, *E. diffusus* in 2, *Hydrophilus triangularis* in 1, and undetermined forms in 2. Weevils (Curculionidae) were found in 3 stomachs, *Hypera punctata* in 2 and undetermined forms in 1; and undetermined ground beetles (Carabidae) were noted once.

The true bugs (Hemiptera), largely aquatic species, were the second most important order in the insect as well as in the animal food. Predominant among those eaten were the broad-shouldered water striders (Veliidae), which furnished the largest food percentage of any insect family and almost a fourth of the entire insect food. They were found in four stomachs, forming a large part of the contents of two, both those of nestlings from Utah. Water boatmen (Corixidae) were found in two stomachs and back swimmers of the species *Plea striola* in one.

The true flies (Diptera), mainly aquatic larvae, were also popular. Soldier flies (*Nemotelus*) were noted in two stomachs; horse flies (*Tabanus*), in 1; and undetermined flies, in two.

Orthoptera, also well liked, were represented by undetermined field crickets (Gryllidae) in two stomachs and by *Gryllus assimilis* in one.

Of the four remaining insect orders noted, three furnished very small percentages (less than 1) of the total food as follows: Odonata supplied dragonflies (Anisoptera) in two stomachs, damselflies (Zygop-

tera) in one, and undetermined forms in four; and Homoptera, represented by leafhoppers (Cicadellidae), and undetermined Hymenoptera were each noted once. Lepidoptera, with a single occurrence, furnished only a trace of the diet.

Mollusks (1.8 percent).—The molluscan food of the juveniles consisted chiefly of snails (Gastropoda), found in four stomachs, but included mussels (Pelecypoda), noted in three. Reporting on the nesting habits of the coot in the Humber Valley marshes near Toronto, Canada, Speirs (1935) stated: "The adults were observed feeding the young with various kinds of animal food, chiefly snails."

Arachnids (0.34 percent).—Spiders (Araneida) were found in a single juvenile stomach.

Other animal food (trace).—Crustaceans were represented in two stomachs by water fleas (*Daphnia*) and in one by crawfish (*Cambarus*); amphibians, in one by a few bones of an undetermined form.

SYSTEMATIC LIST OF FOODS

Table 5 lists in systematic order every food found in the 15 juvenile stomachs and gives the volumetric percentage it contributed to the total food and the number of stomachs in which it was noted.

TABLE 5.—Systematic list of foods in 15 juvenile American coot stomachs, showing volumetric percentages and number of stomachs in which found

PLANT FOOD—53.4 PERCENT

| Food item | Volumetric percentage | Number of stomachs in which found |
|---|-----------------------|-----------------------------------|
| Algae (19.6 percent): | | |
| Filamentous | 6.34 | 3 |
| <i>Chara</i> sp. (muskgrass) | 13.26 | 3 |
| Sparganiaceae (0.26 percent): | | |
| <i>Sparganium eurycarpum</i> (giant burreed) | .26 | 1 |
| Najadaceae (13.68 percent): | | |
| <i>Potamogeton americanus</i> (longleaf pondweed) | (¹) | 1 |
| <i>foliosus</i> (pondweed) | 3.34 | 1 |
| <i>pectinatus</i> (sago pondweed) | .34 | 1 |
| <i>pusillus</i> (pondweed) | (¹) | 1 |
| sp. undetermined | 10.00 | 4 |
| Gramineae: ¹ | | |
| <i>Distichlis stricta</i> (saltgrass) | (¹) | 1 |
| Cyperaceae (18.06 percent): | | |
| <i>Eleocharis palustris</i> (common spikerush) | 3.33 | 1 |
| <i>Scirpus acutus</i> (hardstem bulrush) | 6.00 | 8 |
| <i>paludosus</i> (alkali bulrush) | .40 | 2 |
| sp. undetermined | 6.54 | 3 |
| <i>Carex lactustris</i> (sedge) | .93 | 1 |
| sp. undetermined | .86 | 1 |
| Lemnaceae (0.34 percent): | | |
| <i>Lemna</i> sp. (duckweed) | .34 | 1 |
| Polygonaceae (0.13 percent): | | |
| <i>Rumex</i> sp. (dock) | (¹) | 1 |
| <i>Polygonum amphibium</i> (water smartweed) | (¹) | 1 |
| <i>lapathifolium</i> (noddling smartweed) | .13 | 1 |
| <i>persicaria</i> (ladysthumb) | (¹) | 1 |
| Compositae: ¹ | | |
| <i>Ambrosia artemisiifolia</i> (ragweed) | (¹) | 1 |
| Undetermined plant debris | 1.33 | 1 |

¹ A trace, or less than 0.01 percent.

TABLE 5.—Systematic list of foods in 15 juvenile American coot stomachs, showing volumetric percentages and number of stomachs in which found—Continued

ANIMAL FOOD—46.6 PERCENT

| Food item | Volumetric percentage | Number of stomachs in which found |
|---|-----------------------|-----------------------------------|
| CRUSTACEA ¹ | | |
| <i>Daphnia</i> sp. (water fleas)..... | (1) | 2 |
| <i>Cambarus</i> sp. (crawfishes)..... | (1) | 1 |
| INSECTA (41.46 PERCENT) | | |
| Orthoptera (7.28 percent): | | |
| Gryllidae (crickets): | | |
| <i>Gryllus assimilis</i> | 5.54 | 1 |
| Undetermined..... | 1.74 | 2 |
| Odonata (0.94 percent): | | |
| Anisoptera (dragonflies)..... | .20 | 2 |
| Zygoptera (damselflies)..... | .34 | 1 |
| Undetermined..... | .40 | 4 |
| Hemiptera (11.46 percent): | | |
| Corixidae (water boatmen)..... | 1.46 | 2 |
| Veliidae (broad-shouldered water striders)..... | 10.00 | 4 |
| Notonectidae (back swimmers): | | |
| <i>Plea striola</i> | (1) | 1 |
| Homoptera (0.33 percent): | | |
| Cicadellidae (leafhoppers)..... | .33 | 1 |
| Coleoptera (15.8 percent): | | |
| Carabidae (ground beetles)..... | .06 | 1 |
| Dytiscidae (predaceous diving beetles): | | |
| <i>Dytiscus</i> sp..... | 1.80 | 2 |
| Undetermined..... | 6.54 | 1 |
| Hydrophilidae (water scavenger beetles): | | |
| <i>Enochrus diffusus</i> | 3.66 | 2 |
| sp. undetermined..... | (1) | 1 |
| <i>Hydrophilus triangularis</i> | (1) | 1 |
| Undetermined..... | .34 | 2 |
| Curculionidae (weevils): | | |
| <i>Hypera punctata</i> | 2.20 | 2 |
| Undetermined..... | 1.20 | 1 |
| Lepidoptera..... | (1) | 1 |
| Diptera (8.32 percent): | | |
| Stratiomyidae (soldier flies): | | |
| <i>Nemotelus</i> sp..... | 7.40 | 2 |
| Tabanidae (horse flies): | | |
| <i>Tabanus</i> sp..... | .46 | 1 |
| Undetermined..... | .46 | 2 |
| Hymenoptera..... | .33 | 1 |
| ARACHNIDA (0.34 PERCENT) | | |
| Araneida (spiders)..... | .34 | 1 |
| MOLLUSCA (1.8 PERCENT) | | |
| Gastropoda (snails)..... | 1.66 | 4 |
| Pelecypoda (mussels)..... | .14 | 3 |
| VERTEBRATA ¹ | | |
| Amphibia (salamanders and frogs)..... | (1) | 1 |

¹ A trace, or less than 0.01 percent.

REGIONAL DISTRIBUTION OF FOOD

For the purpose of discussing the food habits on a regional distribution basis, the United States and a small part of Canada have been divided into five food regions (fig. 3, p. 7) as follows: (1) The Atlantic Coast Region, embracing the Atlantic coast from Maine to southern Georgia and extending inland as far as tidewater; (2) the Lower Mississippi and Gulf Region, including the lower Mississippi Valley from southern Illinois and southwestern Indiana to the Gulf of Mexico, extending westward into central and southern Arkansas to include the rice district, the whole of Louisiana and Florida, and the coastal region along the Gulf of Mexico from Texas to Florida; (3) the Humid

Eastern Region, including the remainder of the eastern part of the United States and west to include all of Minnesota and Iowa, eastern Kansas, eastern Oklahoma, and eastern Texas, the small part of Ontario that lies between Michigan and New York, and a small area in northeastern Alberta ⁷; (4) the Arid Western Region, starting at the saline soils at the previously mentioned boundary for the Eastern Region and extending west to central Washington, Oregon, and California, and also including a small portion of southeastern British Columbia to accommodate a series of stomachs taken at Okanagan; and (5) the Pacific Coast Region, embracing the western halves of Washington, Oregon, and California.

A summary of the foods eaten in each of the five regions showing the food percentages contributed by the more important animal and plant groups are given in table 6. The comparative values of the foods as revealed by these data indicate how the various regions affect food habits. It should be borne in mind that the percentages are regional averages and bear no relation to those used in the body of this bulletin, which were calculated on a monthly basis for all the regions combined—the standard method followed in Biological Survey publications on food habits.

TABLE 6.—*Summary, by food regions, of the contents of 792 American coot stomachs, showing main food groups identified and volumetric food and gravel percentages*

| Item | Region | | | | |
|--------------------------------------|----------------|----------------------------|---------------|--------------|---------------|
| | Atlantic Coast | Lower Mississippi and Gulf | Humid Eastern | Arid Western | Pacific Coast |
| Stomachs..... | Number 269 | Number 115 | Number 265 | Number 78 | Number 65 |
| Food groups identified: | | | | | |
| Animal: | | | | | |
| Classes..... | 5 | 6 | 9 | 6 | 4 |
| Orders..... | 11 | 12 | 23 | 13 | 11 |
| Genera..... | 12 | 13 | 49 | 13 | 9 |
| Plant: | | | | | |
| Families..... | 17 | 22 | 23 | 13 | 16 |
| Genera..... | 28 | 39 | 45 | 22 | 24 |
| Plant food: | | | | | |
| Algae: | | | | | |
| Filamentous..... | Percent 0.37 | Percent 1.32 | Percent 5.22 | Percent 7.89 | Percent 3.26 |
| Characeae (muskgrasses)..... | 17.65 | .30 | 6.66 | 18.92 | 2.91 |
| Total..... | 18.02 | 1.62 | 11.88 | 26.81 | 6.17 |
| Najadaceae: | | | | | |
| <i>Potamogeton</i> (pondweeds)..... | 12.82 | 9.12 | 10.43 | 14.67 | 17.65 |
| <i>Ruppia</i> (wigeongrass)..... | 18.72 | 17.75 | | 1.04 | .23 |
| <i>Najas</i> (naiads)..... | 41.78 | 20.39 | 19.24 | 1.76 | 6.85 |
| Other pondweeds..... | .29 | | .15 | | 8.84 |
| Total..... | 73.61 | 47.26 | 29.82 | 17.47 | 33.57 |
| Hydrocharitaceae: | | | | | |
| <i>Vallisneria</i> (wildcelery)..... | 1.22 | 1.50 | 1.18 | | |
| <i>Anacharis</i> (waterweed)..... | 1.82 | | 1.62 | | |
| Total..... | 3.04 | 1.50 | 2.80 | | |

⁷ Boundaries on map were not extended to include this humid part of Alberta, because so few stomachs were obtained here.

TABLE 6.—Summary, by food regions, of the contents of 792 American coot stomachs, showing main food groups identified and volumetric food and gravel percentages—Con.

| Item | Region | | | | |
|--------------------------------------|----------------|----------------------------|---------------|--------------|---------------|
| | Atlantic Coast | Lower Mississippi and Gulf | Humid Eastern | Arid Western | Pacific Coast |
| Plant food—Continued. | | | | | |
| Gramineae: | Percent | Percent | Percent | Percent | Percent |
| <i>Oryza</i> (rice)..... | | | | | 27.63 |
| <i>Avena</i> (oats)..... | | 0.28 | 0.78 | 21.37 | .53 |
| Other grasses..... | 0.94 | 3.93 | 12.37 | 1.21 | 6.41 |
| Total..... | .94 | 4.21 | 13.15 | 22.58 | 34.57 |
| Cyperaceae: | | | | | |
| <i>Eleocharis</i> (spikerushes)..... | | 12.27 | 1.87 | .54 | .17 |
| <i>Scirpus</i> (bulrushes)..... | .35 | 2.08 | 15.33 | 12.15 | 4.11 |
| Other sedges..... | .29 | 5.51 | 1.01 | .60 | 1.91 |
| Total..... | .64 | 19.86 | 18.21 | 13.29 | 6.19 |
| Ceratophyllaceae: | | | | | |
| <i>Ceratophyllum</i> (coontail)..... | .32 | .95 | 5.20 | .05 | 2.12 |
| Lemnaceae (duckweeds)..... | .09 | 5.64 | 2.21 | .78 | .09 |
| Other plant food..... | 2.25 | 16.31 | 6.68 | 5.28 | 10.89 |
| Total plant food..... | 98.91 | 97.35 | 89.95 | 86.26 | 93.60 |
| Animal food: | | | | | |
| Insects..... | .37 | .77 | 6.13 | 11.57 | 1.26 |
| Mollusks..... | .33 | 1.72 | 3.79 | 1.10 | 5.08 |
| Other animal food..... | .39 | .16 | .13 | 1.07 | .06 |
| Total animal food..... | 1.09 | 2.65 | 10.05 | 13.74 | 6.40 |
| Gravel..... | 40.64 | 35.16 | 32.45 | 41.27 | 34.41 |

ATLANTIC COAST REGION

The 269 stomachs collected in the Atlantic Coast Region (fig. 3, p. 7) represented for the most part the fall and winter months. Plant material furnished 98.91 and animal 1.09 percent of the food; and gravel, 40.64 percent of the gross contents of the stomachs.

Plant foods, most of which formed small percentages, were divided among 17 families, with 28 genera recognized. Pondweeds (*Najas*) proved to be the most important food of the region, as they furnished more than three-fourths of the entire diet. More than half of them were naiads (*Najas*); the rest consisted almost entirely of wigeongrass (*Ruppia maritima*) and the true pondweeds (*Potamogeton*), chiefly *P. pectinatus*. Algae, the next important group, were made up predominantly of muskgrasses (Characeae)—largely *Chara* (14.35 percent) and some *Nitella*—but included filamentous algae. The Hydrocharitaceae, third in value, supplied wildcelery (*Vallisneria spiralis*) and waterweed (*Anacharis*). The less popular plant families, no one of which contributed as much as 1 percent of the total food, comprised grasses (Gramineae) sedges (Cyperaceae), coontails (Ceratophyllaceae), duckweeds (Lemnaceae), and others.

Animal foods, distributed among 11 orders of 5 classes, with 12 genera identified, were about equally divided among insects, mostly

dragonflies and beetles; mollusks, consisting of mussels and 5 species of snails; and other animal food.

LOWER MISSISSIPPI AND GULF REGION

The Lower Mississippi and Gulf Region (fig. 3, p. 7) was represented by 115 stomachs collected in nearly every month, but chiefly in winter. Plant food contributed 97.35 and animal 2.65 percent of the diet; and gravel, 35.16 percent of the gross stomach contents.

The plant food was supplied by representatives of 22 families, and 39 genera were identified. As in the Atlantic Coast Region, the Najadaceae were the dominant food and comprised the same 3 groups in the same order of importance, namely, naiads, wigeongrass, and the true pondweeds. The family supplied only about half the total food, however, as compared to three-fourths in the former region, owing to the decrease by about half in the percentage of food furnished by the naiads. The Cyperaceae, consisting dominantly of spikerushes but including bulrushes and others, ranked second. The Lemnaceae, the third-ranking family, were more important in this region than in any of the others, furnishing a little more than a twentieth of the entire food. The grasses, insignificant in the Atlantic Coast Region, were fairly important here but not nearly so much so as in the 3 succeeding regions. Algal forms, consisting of filamentous algae mainly and of some muskgrasses, were not much used. The Hydrocharitaceae, represented by wildcelery, and Ceratophyllaceae, by coontail, were relatively unimportant. The other plants eaten comprised undetermined vegetation (7.81 percent) and many vegetative organisms that furnished traces or small percentages only, few of them more than 1 percent of the total diet.

Although animal food formed a very small part of the diet, it was derived from 12 orders of 6 classes, and 13 genera were recognized. Between six- and seven-tenths of it consisted of snails, predominantly *Neritina reclivata* (1.27 percent), and almost three-tenths, of insects, mostly beetles and grasshoppers. The other animal items in the food were insignificant.

HUMID EASTERN REGION

The 265 stomachs collected in the Humid Eastern Region (fig. 3, p. 7) represented every month. Plant food supplied 89.95 and animal 10.05 percent of the diet; and gravel, 32.45 percent of the gross stomach contents.

Plant foods, many of which contributed only small percentages or traces of the total diet, were distributed among 45 genera representing 23 families. The pondweeds were again dominant, but by a much smaller margin. Those taken were almost entirely species of *Najas* and *Potamogeton*. Wigeongrass, so popular in the 2 regions already

discussed, was not found in the stomachs, doubtless because it is a rare plant in this region. The Cyperaceae, next in importance, were represented predominantly by bulrushes but also by spikerushes and others. The grasses, third in value, were much more important than in the 2 preceding regions but less so than in the 2 following. Algal forms, consisting of muskgrasses (mostly *Chara*) and filamentous algae, were used a great deal. Coontail (*Ceratophyllum demersum*) supplied about a twentieth of the food, much more than it furnished in any of the other regions. The Hydrocharitaceae, made up of waterweed and wildcelery in about equal proportions, and the Lemnaceae were of some importance, but none of the other plants eaten were of enough value in the diet to be mentioned here.

Although animal material formed only a tenth of the total food, it was derived from 23 orders and 9 classes, and 49 genera were identified. Practically six-tenths was furnished by insects, mainly dragonflies, grasshoppers, true bugs, and beetles; and nearly four-tenths, by mollusks, consisting of mussels and clams (2.19 percent) and snails (1.6 percent). The other animal food noted was insignificant.

ARID WESTERN REGION

The 78 stomachs from the Arid Western Region (fig. 3, p. 7) were collected mainly in summer. Some spring and fall material was included, but little winter. Plant food furnished 86.26 and animal 13.74 percent of the total food; and gravel, 41.27 percent of the gross stomach contents.

The plant foods were derived from 13 families, in which 22 genera were identified. Notable features of the diet, as compared with the 3 regions already discussed, are that algae and grasses rose greatly in popularity and pondweeds dropped. Algae furnished the largest food percentage: muskgrasses contributed about seven-tenths of the bulk and filamentous algae the rest. Grasses ranked second, and more than nine-tenths of the bulk consisted of oats (*Avena sativa*), put out as bait, that were found in the stomachs of coots from the Lake Malheur region of Oregon. Pondweeds, third in importance, consisted predominantly of species of *Potamogeton*, but naiads and wigeongrass occurred sparingly. The naiads made the greatest drop in food percentage, undoubtedly because of their relative scarcity in the region. Sedges were quite important: bulrushes contributed practically all the percentage and spikerushes and other sedges the remainder. The other plants eaten were relatively unimportant in the diet.

Most of the animal food, in which 13 orders of 6 classes were represented and 13 genera identified, consisted of insects that made up food percentages as follows: Grasshoppers, 1.61; Odonata, 0.27; Hemiptera, chiefly water boatmen and broad-shouldered water striders

(Veliidae), 4.22; beetles, mainly diving beetles, 3.7; Diptera, largely the larvae of soldier flies (*Nemotelus* and *Odontomyia*), 1.61; and miscellaneous insects, 0.16. The large increase in the quantity of insects consumed over that of the regions previously treated, indicates that the different availability of this food in the arid region is the principal factor governing selection. Some mollusks (mussels and snails) were taken. The other animal food was made up of miscellaneous forms of no special importance.

PACIFIC COAST REGION

The 65 stomachs collected in the Pacific Coast Region (fig. 3, p. 7) represent nearly every month. A number of them were collected in California in January, however, which greatly influenced the food percentages for the region. Plant food supplied 93.6 and animal food 6.4 percent of the total diet; and gravel, 34.41 percent of the gross stomach contents.

The plant food was derived from 16 families, represented by 24 genera. Most important were the grasses and pondweeds, each of which contributed a little more than a third of the entire food of the region, with grasses slightly in the lead. The bulk of the latter consisted of rice (*Oryza sativa*), the high percentage being due to the fact that about one-third of the birds representing the region were collected in and about the rice fields of Maxwell, Calif., and a number of them had fed largely on the seeds of this cultivated grain. In defense of the coots it must be stated that a good many of the other native grasses found in the stomachs came from districts where there was ample opportunity to eat rice. Although pondweeds are not as common in this region as in many other parts of the country, nevertheless they furnished a high enough percentage of the diet to be included among the most important foods of the coot. More than half the pondweed percentage was derived from species of *Potamogeton*, about a fifth from naiads, and the remainder from wigeongrass (taken very sparingly) and other pondweeds. The sedges and algae contributed almost identical food percentages. The former consisted mostly of bulrushes but included spikerushes and other forms; the latter, of filamentous algae and muskgrasses, the algae bulking slightly larger. The Ceratophyllaceae were represented by the coontail. The other plant families noted were of little importance in the food.

The animal food was divided among 11 orders of 4 classes, and 9 genera were recognized. Almost four-fifths of it was made up of mollusks, consisting mostly of snails (largely *Fluminicola virens*) but including some mussels; and nearly one-fifth, of insects, chiefly beetles and dragonflies. The other food found was insignificant.

ECONOMIC STATUS OF THE AMERICAN COOT

As previously stated (p. 32), vertebrate foods played a very minor part in the diet of the coots examined, and no trace of birds or their eggs was found in any of the 801 stomachs. From this evidence it is safe to say that the American coot seldom harms vertebrate animals. This should not be construed to imply that occasional individuals will not depart from the usual diet but that under normal circumstances vertebrates are certainly unimportant in the diet. Collinge (1936) reported that in his examination of 157 stomachs of the European coot (*Fulica atra atra*) animal material formed only about 16 percent of the total food and the only traces of birds found were what appeared to be part of a duckling and some remains of another bird.

The most serious depredations committed by the coot are on cultivated rice (*Oryza sativa*), but they pertain to a highly restricted area, the rice fields of California, where the associated sloughs and large expanses of shallow water are admirably suited to the bird's feeding habits. In 1886, Holmes⁸ wrote that although the mud hen is supposed to do a great deal of damage it bites off only the young shoot instead of pulling up the grain and is destructive only along the particular slough frequented. This would seem to indicate that the Stockton Independent (Anonymous 1887) related an uncommon or rare event and not a normal habit when it reported serious damage by coots near Roberts Island, stating: "They begin at the land's edge and penetrate about a mile inland, eating every spear of grain as they go" and adding that thousands of the "pests" had been destroyed in an effort to save the crop.

This depredation of more than 50 years ago is the worst one reported. More recent accounts are less disparaging. In writing from Berkeley, Calif., on May 11, 1929, of actual damage to rice fields that he had been asked to investigate, Tonkin⁹ stated that although examination of several stomachs showed that coots had been eating rice to some extent, the seriousness of the damage was somewhat overrated, as the birds inhabited the poorer parts of the fields where the native aquatic plants had not been thinned out. He suggested that the other vegetation, as well as the rice, had attracted them. Several other letters indicated slight damage but only a few reported killing the birds. An article in the Marysville Appeal-Democrat (Anonymous 1932) described the injury done by coots to the rice crop in the vicinity of Willows and the subsequent shooting of the birds to protect the crop.

⁸ Holmes, J. H.: Letter in Biological Survey files.

⁹ Tonkin, George: Letter in Biological Survey files.

Various methods have been used to frighten waterfowl away from rice fields. Searchlights, fireworks, and aerial bombs have proved highly successful in driving off ducks, but it remains to be seen whether these or similar devices will scare the coot. Firearms are of little value, as the accounts in which their use is described conclude with a statement to the effect that the birds were not frightened and rarely left the vicinity. Before the coot was placed on the list of protected migratory waterfowl, poisoning was tried in some cases but was not effective. Studies concerned with the development of devices for scaring the birds away from or preventing them from entering the rice fields should prove of value, and recommendations of methods that will protect both the birds and the rice crops are most desirable.

Coots have caused incidental damage to various other crops on several occasions, none of them of more than local import. Goldman¹⁰ noted that they trampled over alfalfa on reclaimed land near the sloughs near Brentwood, Calif., late in the fall of 1907. Ransom¹¹ reported on April 18, 1929, that they ate cull onions scattered about in a field of newly planted grain but did not take the grain, despite reports and complaints that they did. Other accounts reported that they consumed grazing grass, thus financially harming dairymen, and destroyed young beets, but the damage probably was exaggerated in both instances.

It is evident from these accounts that aside from damage done to rice at certain times of the year in restricted areas in California, the American coot is normally an inoffensive bird.

SUMMARY

The results of laboratory analyses of the contents of 801 American coot stomachs, 792 of which were found suitable for tabulation of food percentages, show that the bird is primarily a vegetarian. Although its diet included a wide variety of both plant and animal items, nearly nine-tenths of the bulk of its food was derived from the vegetable kingdom.

The principal plant foods were pondweeds (*Potamogeton*, *Najas*, and *Ruppia*), which provided two-fifths of the total diet; sedges (mainly *Eleocharis*, *Scirpus*, and *Carex*); algae; and grasses. A wide variety of plant items were taken accidentally or incidentally, the results of haphazard feeding methods; many items were found only once.

Animal foods, which were of little importance except in summer, consisted largely of insects (beetles, dragonflies, and bugs mostly)

¹⁰ Goldman, E. A.: Field notes in Biological Survey files.

¹¹ Ransom, W. H.: Letter in Biological Survey files.

and mollusks (both univalves and bivalves). Fishes and amphibians were relatively valueless, and no other vertebrate material was noted.

Gravel, including fine sand, was used liberally as a digestive aid, averaging approximately a third of the gross contents of the stomachs. Coot feathers, mere traces, doubtless ingested while preening, were noted in many stomachs. Lead shot was rarely found, indicating that there is little danger of severe outbreaks of lead poisoning, as have been noted among ducks.

Regional division of data showed the same general types of foods to be popular throughout the entire country; identifications differed largely within the groups according to the individual plant ranges.

The food habits of the coot were found to be inoffensive normally. Destruction of fish was negligible, and no evidence of harm to nestling birds or to eggs was found. In a few instances, however, the food habits of the bird were shown to be detrimental; damage to rice crops locally in California in some cases constituted a real menace. The use of frightening devices to drive the birds away from the fields or to keep them from entering is considered preferable to sporadic shooting, as experiments with the latter have proved it to be of no lasting benefit.

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